

THE ADULT POLYCENTROPODIDAE OF CANADA AND ADJACENT UNITED STATES

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ABSTRACT

Of the 46 species reported here from Canada and adjacent States of the United States, four belong to the genus Cernotina Ross, one to Cynellus (Banks), three to Neureclipsis McLachlan, five to Nyctiophylax Brauer, and 33 to Polycentropus Curtis. Keys are provided (for males and females, both, where possible) to genera and species. For each species the habitus is given in some detail, with diagnostic statements for the genitalia. Also included are brief statements on biology (if known), and distribution. Distributions are mapped, and genitalia are fully illustrated.

RÉSUMÉ

Quarante six espèces de Polycentropodidae sont mentionnées pour le Canada et les états frontaliers des Etats-Unis, représentant les genres suivants: Cernotina Ross (4), Cynellus (Banks) (1), Neureclipsis McLachlan (3), Nyctiophylax Brauer (5) et Polycentropus Curtis (33). Des clefs d'identification au genre et à l'espèce (pour les mâles et les femelles) sont présentées par l'auteur. Un habitus ainsi qu'une description diagnostique des pièces génitales sont donnés pour chacune des espèces. Une description résume ce qui il y a de connu sur l'histoire naturelle et la répartition géographique de ces espèces. Les aires de distributions et les pièces génitales sont largement illustrées.

INTRODUCTION

This paper brings together information about all species of Polycentropodidae presently known from Canada, or with the potential to be found in Canada. Thus, all species which have been recorded from States of the United States which are contiguous with Canada, but which have not yet been recorded from Canada, are also included here.

The Polycentropodidae is a medium sized family, world-wide, with 46 species recorded from Canada. These species are of one subfamily (Polycentropodinae) distributed among five genera. In course of preparing this paper no new species were discovered. In only a few species are the females yet unknown.

The key to genera is translated from Schmid (1980). For a key to genera of larvae Wiggins (1977) should be consulted. The keys to species are original, make fullest possible use of the illustrations, and have been kept as simple as possible. Use of more than two characters per couplet has been avoided where possible; usually only one character is used.

Characterisations of supra-specific taxa are abridged from Schmid (1980).

In the text for each species a general habitus description is given in some detail. This is based on the male, with mention of the female only when she is significantly different. Regarding adult genitalia, a diagnostic statement only is presented, which makes reference to those characters which will ensure correct recognition of a species in conjunction with the

illustrations. The male and female (where known) genitalia of each species are fully illustrated.

Notes about biology and known distribution (with maps) complete the presentation for each species.

The genera are presented in alphabetical order, as are the species within genera. Only in *Polycentropus* are the species arranged in species groups, each group being designated by a letter of the alphabet. Within groups, the species are arranged alphabetically.

At the beginning of each species treatment in the text, as also for the treatments of each genus and family, a brief synopsis of the synonymy attaching to that taxon is presented, with citations of the more important papers relevant to the history of the taxon. For a complete listing of literature for each taxon, up to 1960 inclusive, Fischer (1962, 1972) should be consulted.

The use of colour here is based on alcohol-preserved material. With such material fading may occur over time, and wing and body hairs may be lost. Wing colouration, therefore, is based on membrane colour. This is the normal situation with fluid-preserved material, which is usual in bulk collecting especially.

Species recognition in adults is based almost entirely on the male and female genitalia. In the males I follow Snodgrass (1957:35) in considering the aedeagus to be the entire evertible assemblage located between the claspers (*i.e.*, inferior appendages). Also, I prefer to use the term *clasper*, rather than *inferior appendage*, as it has the merit of brevity and of describing the apparent function of the appendage in question. The abdominal segments are referred to by use of roman numerals, counting from the abdomen-thorax junction.

From the genitalic illustrations, I omit setae or hairs except in instances where they may be of use in identification of a given species; otherwise they simply clutter the drawing and obscure other features. The genitalia of many species are, however, well invested with setae or hairs.

A final point to note, regarding genitalic descriptions or characterisations, is the use of the singular and plural. Several structures are paired but, in certain views only one member of a pair is visible. When one member only is visible the singular is used. When both are visible, the plural is generally used. Reference to the wings and legs is normally on the basis of one member of each pair.

TECHNIQUES

Refer to Nimmo (1971) for details about collection, preservation, and preparation of material for examination.

GEOGRAPHICAL DISTRIBUTION

A distribution map, or maps, is presented for each species treated here. For those species presently known from Canada a detailed map of the Canadian distribution is given, accompanied by an inset map of North America which presents a by-State/Province synopsis of the total known distribution in North America. For those species not yet recorded from Canada only the overall North American map is given. Distributions are correct to mid-1981.

The State records for the United States portion of the North American maps are derived from publications. Most of the detailed Canadian records are new to the literature and are derived from examination of museum or newly collected material. Such detailed records as were obtained from publications are considered trustworthy and no distinction is made on the

maps.

A fair number of species recorded here are transcontinental in distribution, either narrowly, or widespread; two of these species are also Holarctic, being known from Eurasia as far west as western Europe. A very small proportion of species is confined to the Rocky Mountain foothills and/or westward. The remainder are known only from east of the foothills. Apart from three species known only from single localities, none appear to be limited to the Great Plains. Of the remainder, information is still rather scanty in many instances, but there appear to be distributions among them which are centered on the Appalachians, about the Great Lakes, or to the south of the Great Lakes. One eastern species is known to extend southward through Central America as far as the Amazon basin.

With the exception of some records from high on the eastern coast of Hudson's Bay, the family appears to be limited northward by the tree line.

THE FAMILY POLYCENTROPODIDAE ULMER

Polycentropodidae Ulmer, 1903:83; Betten, 1934:116, 120, 207; Ross, 1944:51.

Polycentropodidae; Brues & Melander, 1915:47; Milne, 1936:63, 83; Wiggins, 1977:341; Schmid, 1980:63. (part); Ross, 1944:51.

Description.— Small, robust, densely hirsute; fore-wings with distinct golden areas. Ocelli absent. Vertex of head with large warts; thickly clothed with silken hairs. Antennae thick, flagellar annuli short. Maxillary palpi of five articles in both sexes; basal two articles generally short, subequal; fifth article flagellate; third article always inserted slightly basad of the apex of the spinate second article. Spur formula 3,4,4, or 2,4,4; spurs hirsute. Gland of abdominal sternum V large, with exit at base of a generally well developed, filiform lobe. Wings (Fig. 1–5) heavily hirsute; fore- and hind-wings similar, with elliptical tips. Venation complete, with fl–fV on fore-wing, and fl–III and fV on hind-wing. A tendency to simplification is sometimes evident in fl and fIII being missing, and fl is petiolate. In fore-wing, cross-veins Sc–R1 and R1–R2 usually present; discoidal, median, and thyridial cells long, closed; thyridial cell always in contact with median cell; discoidal cell always originated basad of median cell. In hind-wing, R1 complete or variously reduced and confluent with Sc; discoidal cell open or closed; two or four free anal veins.

Genitalia. Male (Fig. 6–9, 21–26, 27–32, 43–45, 61–65, etc.). Robust, bulky, with basic structure similar throughout genera. Segment IX well developed ventrally (Fig. 6, 21, 27, 43, 61); almost, or entirely lacking dorsally. Segment X a membranous lobe, rarely with any sclerotisation. Preanal appendages more or less elongate lobes with large bases. Intermediate appendages generally spinate or lobes; vestigial in some species; fused to bases of preanal appendages. Vento-mesal angles of intermediate appendages produced mesad, fused to form bridge dorsad of aedeagus. Claspers (inferior appendages) of one article, more or less complex, more or less projected posterad, quite distinct entities. Aedeagus (Fig. 9, 22, 29, 57, 65) large, located high in genital capsule between preanal appendages; modified by reduction of parts; without parameres (lateral arms).

Genitalia. Female. (Fig. 10–11, 25–26, 31–32, 46–47, 66–67.). Very similar throughout genera. Sternum VIII quite divided to two halves as freely movable lobes; the two lobes well separated (Fig. 11). Segment X large (Fig. 10), with ventral angles produced to form a large vulval scale, the base of which encloses the ano-vaginal cavity. Segment IX postero-dorsal edge produced posterad as hairless papillae which flank the similar cerci. Ano–vaginal aperture ventrad of segment X.

The family is world-wide in distribution. Of five recognised subfamilies (Wiggins, 1977) (or two; Schmid, 1980), only one, the Polycentropodinae, is known from North America. Five genera and 46 species are known to occur in Canada, or to have the potential to be found here.

The larvae live in standing waters, and flowing waters which are not usually too turbulent. They construct fixed retreats and nets of greater diversity than in any other family (see Wiggins (1977) for illustrations of North American types).

Key to known or potential genera of Polycentropodidae of Canada

- | | | | |
|----|---------------------------------------|-------|---------------------------------------|
| 1a | Spur formula 2,4,4 | ..... | <i>Cernotina</i> Ross, p. 146 |
| 1b | Spur formula 3,4,4 | ..... | 2 |
| 2a | (1b) Hind-wing fIII present (Fig. 3b) | ..... | <i>Neureclipsis</i> McLachlan, p. 158 |

- 2b Hind-wing fIII absent (Fig. 5b) 3
- 3a (2b) Both wings with fI absent (Fig. 4a-b) 4
- 3b Fore-wing with fI present, and absent or present in hind-wing (Fig. 5a-b) *Polycentropus* Curtis, p. 174
- 4a (3a) Maxillary palpi with second article three times as long as third *Nyctiophylax* Brauer, p. 165
- 4b Maxillary palpi with second article slightly shorter than third *Cyrnellus* Banks, p. 155

Genus *Cernotina* Ross

Maps 1-4; Fig. 1, 6-20

Cernotina Ross, 1938a:11 (in Psychomyiinae); Ross, 1938b:136; Ross, 1944:54; Schmid, 1980:69.

Description.— Basal two articles of maxillary palpi very short. Spur formula 2,4,4. Wings narrow, elongated. Hind-wing slightly larger than fore-wing, distally blunt (Fig. 1-b). Venation somewhat simplified. Fore-wing with cross-vein C-Sc absent; Sc short; fI, fIII absent; discoidal cell short; median cell open. Hind-wing Sc much thickened, R1 very close to it; fI, fIII absent; discoidal cell open; with two anal veins.

Genitalia: Male. (Fig. 6-9, 12-20). Quite varied in character of appendages. Segment IX triangular (Fig. 6). Segment X inserted at dorsal angle of segment IX, membranous, bifid, hirsute (not shown here). Preanal appendages elongate, acuminate, often pincer-like (Fig. 8), often spinate, dentate on mesal face. Intermediate appendages apparently absent, or fused with mesal face of preanal appendages; basally in form of two slightly sclerotised lobes, pilose, projected mesad over aedeagus but not as complete bridge. Claspers (inferior appendages) large, complex, with distinct dorsal process (Fig. 6). Aedeagus simple, slender, comprised of baso-dorsally sclerotised phallosome and endosoma around oval phalotremal sclerite.

Genitalia: Female. (Fig. 10-11). Elongate. Sternum VIII reduced, as two slender, lateral lobes. Segment X elongate, indented dorsally, with ventral extremities concealed. Segment XI large, slanted antero-ventrad. No vulval scale.

Cernotina is a New World genus. Well represented in the Neotropical region, there are about 12 species known from North America, of which two are recorded from Canada. Two further species may eventually be found east of the Great Lakes.

Key to known or potential species of *Cernotina* Ross of Canada

- 1a Females (Fig. 10-11). Cannot be keyed further as suitable characters not yet known.
- 1b Males (Fig. 6, 12, 15, 18) 2
- 2a (1b) Dorsal lobe of clasper slanted postero-dorsad in lateral aspect (Fig. 12, 18) 3
- 2b Dorsal lobe of clasper curved or directed dorsad or slightly dorso-anterad in lateral aspect (Fig. 6, 15) 4
- 3a (2a) Ventral lobe of clasper blunt, rounded, not bifid in lateral aspect (Fig. 18) *C. spicata* Ross, p. 148
- 3b Ventral lobe of clasper bifid distally, in lateral aspect (Fig. 12) *C. ohio* Ross, p. 147
- 4a (2b) Preanal appendage, in lateral aspect (Fig. 6), short, blade-like *C. calcea* Ross, p. 147
- 4b Preanal appendage, in lateral aspect (Fig. 15), long, slender, strap-like, coiled mesad *C. pallida* (Banks), p. 147

Cernotina calcea Ross

Map 1; Fig. 6–11

Cernotina calcea Ross, 1938b:137; Ross, 1941:77; Ross, 1944:72; Schmid, 1980:Fig. 185–186.

Description.— Fore-wing length of male 3.88 mm; yellow-brown, no evident pattern. Antennae uniform pale straw. Vertex of head pale brownish yellow. Spurs straw, hirsute; lateral spur of each mid- and hind-leg pair notably shorter than mesal companion. Thorax overall light yellowish brown. Legs straw; cream in female.

Genitalia. Male. (Fig. 6–9). (Specimen from Honey Ck, Turner Falls State Park, Oklahoma, USA – paratype). Males distinguished by ventral lobe of clasper bifid distally, with dorsal branch curved ventrad (Fig. 6); by dorsal lobe of clasper curved dorsad; and by preanal appendage broadly blade-like.

Genitalia. Female. (Fig. 10–11). (Specimen from Mt Pine, Arkansas, USA). Females for all species are as in Fig. 10–11. No characters have yet been discovered to separate them. Characters to separate these females from females of other genera will be found above, under *Cernotina*.

Biology.— Ross (1944) states that adults of this species live near clear, cool streams. He gives the adult flight season as June 29 to August 1.

Distribution.— Not yet known from Canada. Otherwise this species is recorded from Illinois to Florida and Mexico (map 1).

Cernotina ohio Ross

Map 2; Fig. 12–14

Cernotina ohio Ross, 1939:628; Ross, 1944:73.

Description.— Fore-wing length of male 3.72 mm; uniform brownish straw overall. Spurs hirsute; lateral spur of each mid- and hind-leg pair notably shorter than mesal companion.

Genitalia. Male. (Fig. 12–14). (Specimen from Put-in-Bay, Ohio, USA. – holotype). Males distinguished by bifid ventral lobe of clasper, with dorsal branch projected posterad (Fig. 12); by dorsal lobe of clasper directed postero-dorsad; and by preanal appendage, in lateral aspect, tapered to distal spinate tip, from broad, curved base (the tip is sinuate).

Genitalia. Female. See remarks under *C. calcea*, above.

Biology.— The only date I have for this species is July 19, for the holotype.

Distribution.— Not yet known from Canada. Otherwise, still only known from the Lake Erie shore of Ohio, USA (map 2).

Cernotina pallida (Banks)

Map 3; Fig. 15–17

Cernotina pallidus Banks, 1904:214.*Nyctiophylax pallidus*; Banks, 1907a:48; Betten, 1934:225.*Polycentropus pallidus*; Milne, 1936:85, 88.*Cernotina pallida*; Ross, 1938a:11; Ross, 1944:73; Schmid, 1980:Fig. 187–189.

Description.— Fore-wing length of male 4.20 mm. Adults uniform brownish straw, overall. Spurs with lateral member of both mid-leg pairs, and apical pair of hind-leg, notably shorter than mesal companion; all hirsute.

Genitalia. Male. (Fig. 15–17). (Specimen from Put-in-Bay, Ohio, USA). Males distinguished by ventral lobe of clasper bifid distally, with dorsal branch directed posterad (Fig. 15); by dorsal lobe of clasper directed slightly dorso-anterad; and by preanal appendages with long, narrow, strap-like processes coiled back on themselves (Fig. 15, 17).

Genitalia. Female. See remarks under *C. calcea* above.

Biology.— Canadian dates for flight season range from July 12 to 24.

Distribution.— Recorded from Ohio to Virginia, New Hampshire, and southern Ontario (map 3). In Canada this species is presently only known from two localities in southern Ontario – Marmora, and the Muskoka district.

Cernotina spicata Ross

Map 4; Fig. 1, 18–20

Cernotina spicata Ross, 1938a:138; Ross, 1944:73.

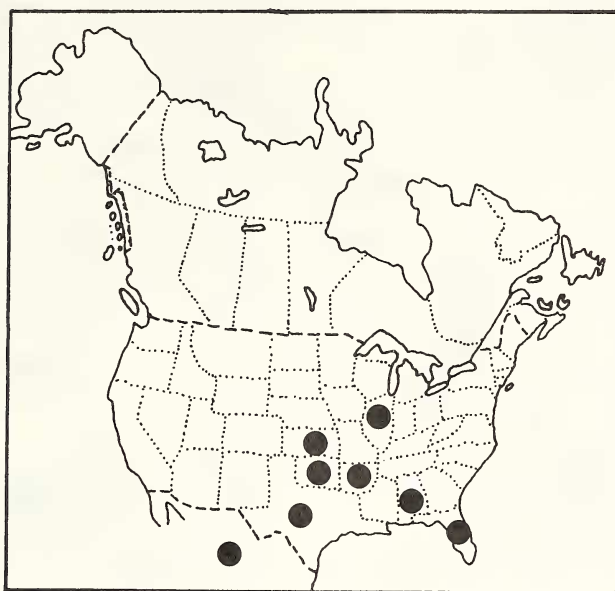
Description.— Fore-wing length of male 3.76 mm; very pale brownish yellow overall. Spurs with lateral spur of each pair shorter than mesal companion.

Genitalia. Male. (Fig. 18–20). (Specimen from Factory Brook, Middlefield, Massachusetts, USA). Males recognised by ventral lobe of clasper (Fig. 18) not distally bifid; by dorsal lobe of clasper directed postero-dorsad; and by preanal appendage, in lateral aspect, with large base, paired ventral lobes, and arcuate, blade-like dorsal process curved postero-ventrad.

Genitalia. Female. See remarks under *C. calcea* above.

Biology.— Canadian adult flight records range from July 8 to 25. Morse & Blickle (1953) give a range in New Hampshire of June 5 to August 27.

Distribution.— From Oklahoma and Kansas to Florida, Maine, and southern Ontario (map 4). In Canada this species has been recorded from the Muskoka district, and Arnprior, Ontario.



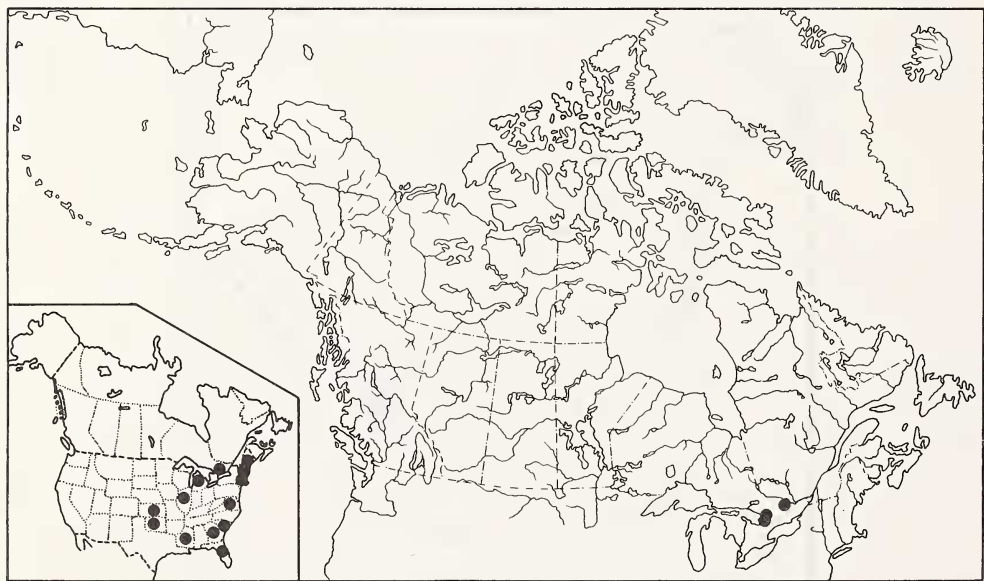
Map 1. Known distribution of *Cernotina calcea* Ross in North America, by state.



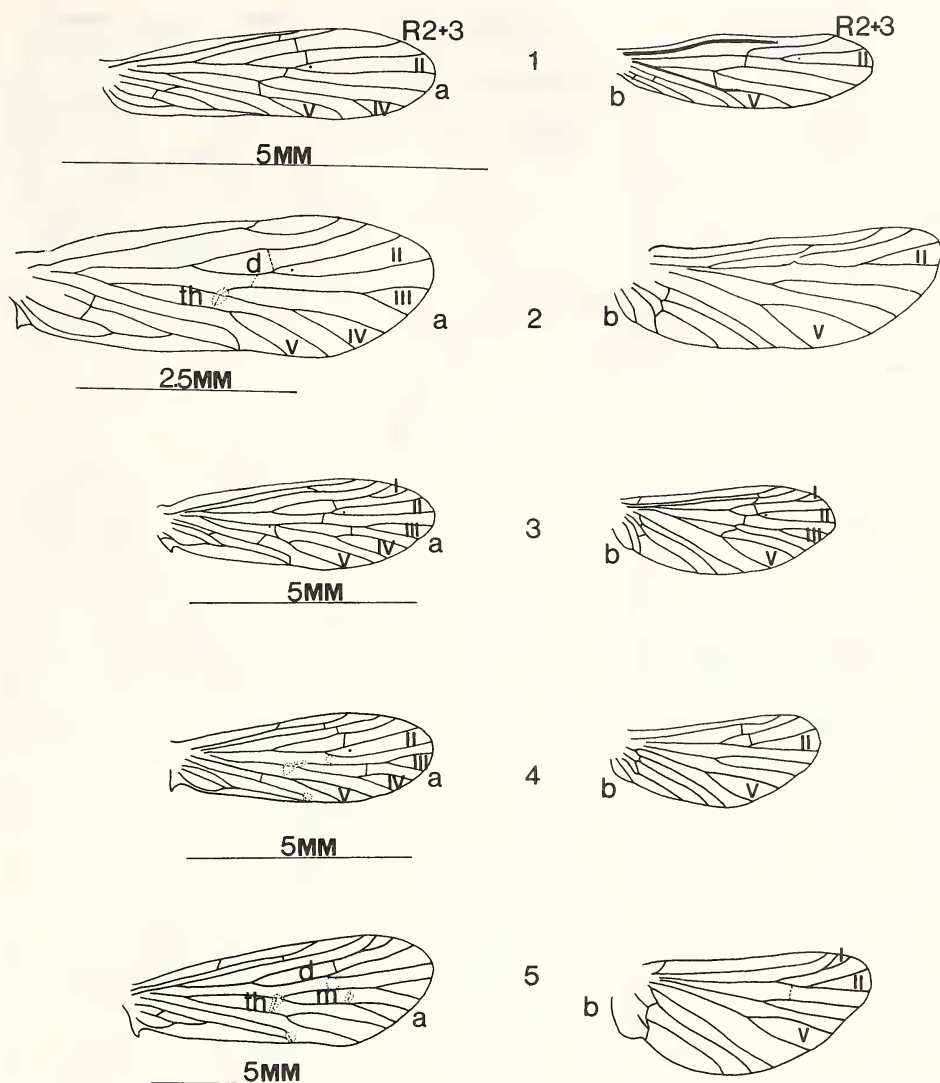
Map 2. Known distribution of *Cernotina ohio* Ross in North America, by state.



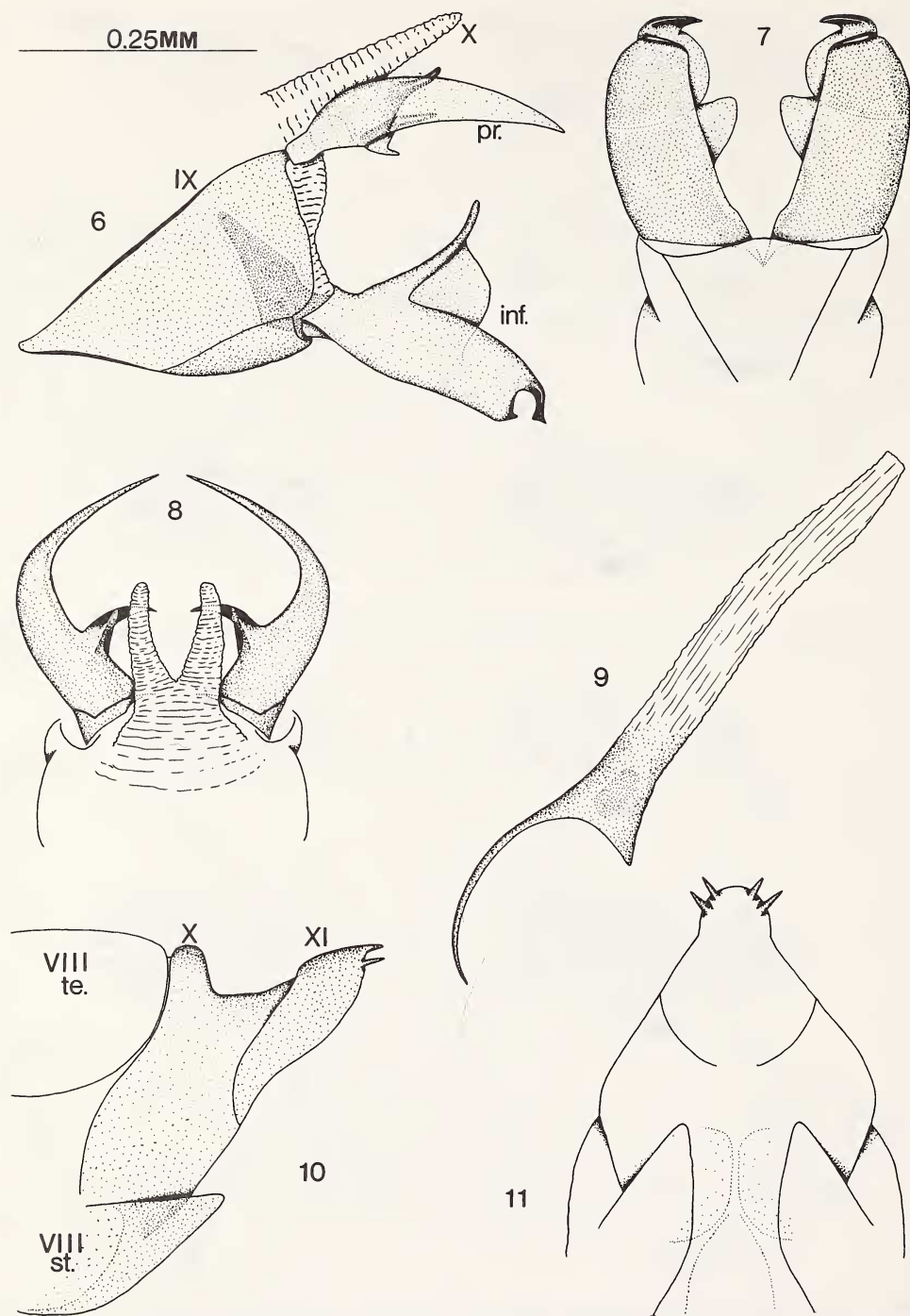
Map 3. Collection localities for *Cernotina pallida* (Banks) in Canada, with known distribution in North America by state or province.



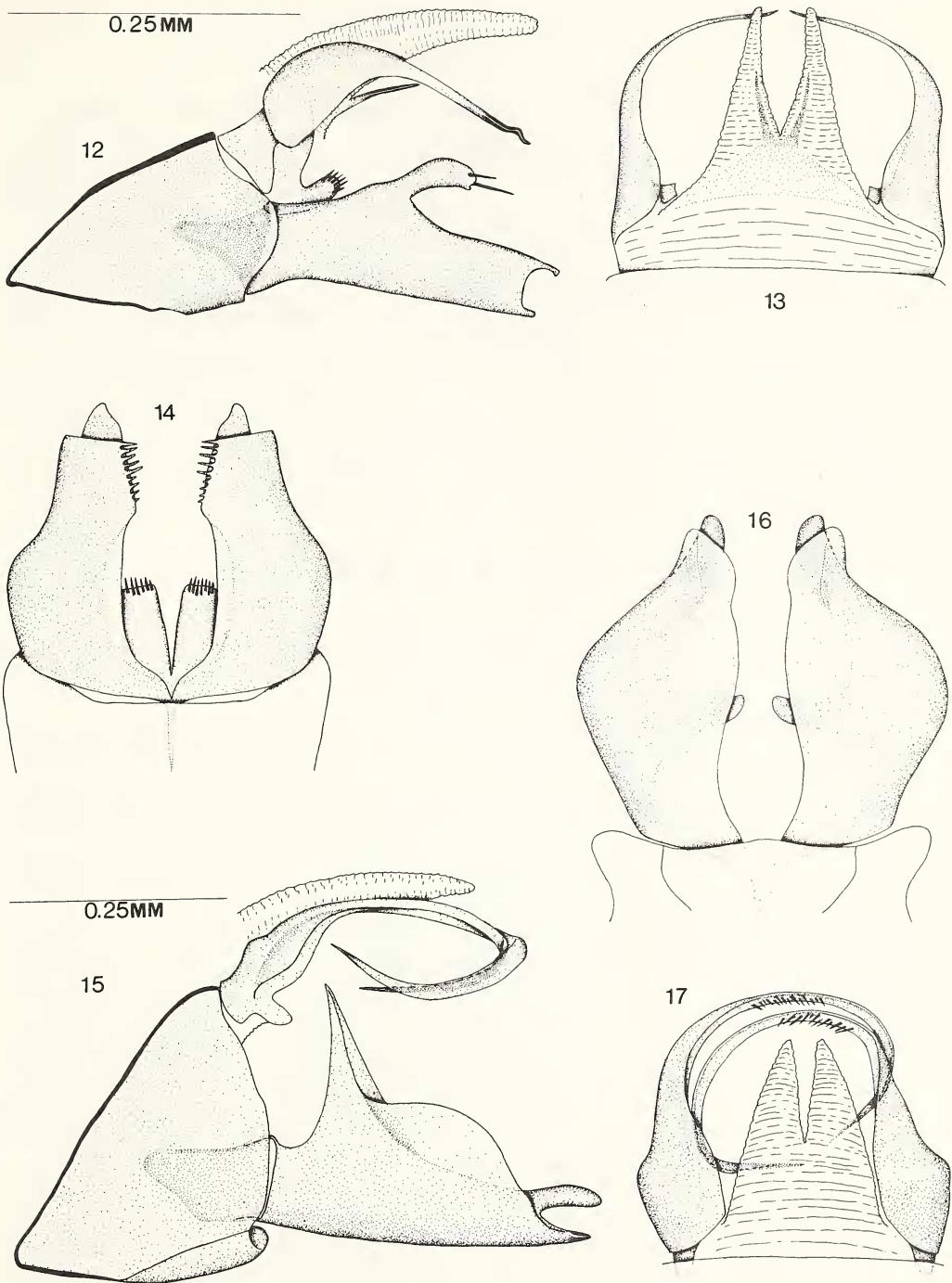
Map 4. Collection localities for *Cernotina spicata* Ross in Canada, with known distribution in North America by state or province.



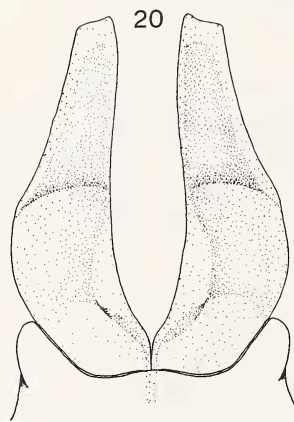
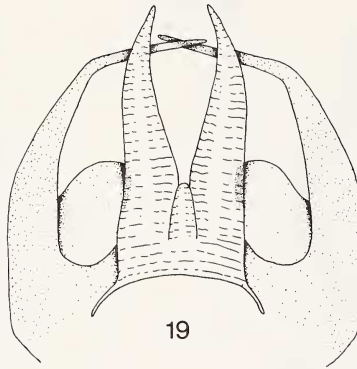
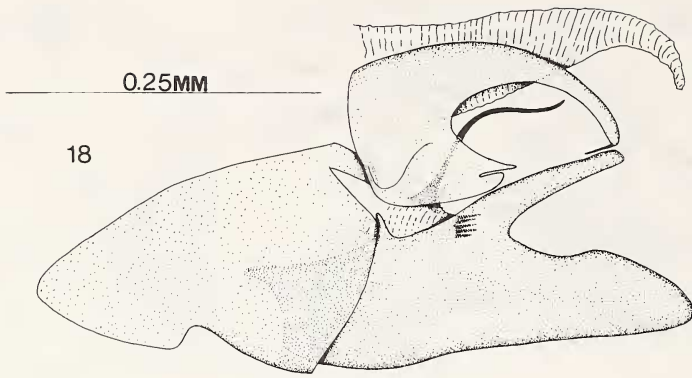
Figs. 1-5. Wing venation, males. 1, *Cernotina spicata* Ross. 2, *Cynellus fraternus* (Banks). 3, *Neureclipsis crepuscularis* (Walker). 4, *Nyctiophylax banksi* Morse. 5, *Polycentropus colei* Ross. 'a' figures are fore-wings; 'b' are hind-wings. Legend: d.—discoidal cell; th.—thyridial cell; I, II, III, IV, V — apical cells.



Figs. 6-11. *Cernotina calcea* Ross: 6, genital capsule of male, lateral aspect; 7, genital capsule of male, ventral aspect; 8, genital capsule of male, dorsal aspect; 9, aedeagus of male, lateral aspect; 10, genital segments of female, lateral aspect; 11, genital segments of female, ventral aspect. Legend: inf. - clasper; pr. - preanal appendage; st. - sternum; te. - tergum; VIII, IX, X - body segments.



Figs. 12-17. 12-14, *Cernotina ohio* Ross: 12, genital capsule of male, lateral aspect; 13, genital capsule of male, dorsal aspect; 14, genital capsule of male, ventral aspect. 15-17, *Cernotina pallida* (Banks): 15, genital capsule of male, lateral aspect; 16, genital capsule of male, ventral aspect; 17, genital capsule of male, dorsal aspect.



Figs. 18-20. *Cernotina spicata* Ross: 18, genital capsule of male, lateral aspect; 19, genital capsule of male, dorsal aspect; 20, genital capsule of male, ventral aspect.

Genus *Cyrnellus* Banks

Map 5; Fig. 2, 21–26

Cyrnellus Banks, 1913:88; Ross, 1944:71; Flint, 1964:28; Wiggins, 1977:344; Schmid, 1980:68.

Description.— Small, stout insects, heavily hirsute. Second article of maxillary palpus almost as long as third; third article inserted subapically on second. Spur formula 3,4,4. Hind-wing little longer than fore-wing. Venation slightly simplified, not modified. Fore-wing with fl absent; median cell open. Hind-wing with veins in centre of wing slender; R1 short, very close to Sc; fl and fIII absent; discoidal cell open.

Genitalia. Male. (Fig. 21–24). Antero-ventral portion of segment IX markedly projected anterad (Fig. 21). Segment IX dorsum fused to large segment X. Segment X expanded posteriorly, setose, slightly sclerotised. Preanal appendages long, ovoid. Intermediate appendages small, slightly sclerotised, located basad; with basal parts of two triangular lobes located dorsad of aedeagus. Claspers (inferior appendages) large, simple, stout, with large, conical process on mesal face (Fig. 23). Aedeagus simple, short, thick, with phallosome and simple endotheca; not spinate; with large, internal, phallosomal sclerite (Fig. 22).

Genitalia. Female. (Fig. 25–26). Elongate. Sternum VIII visible between large, lateral lobes. Segment X long, with ventral extremity concealed between lateral lobes of sternum VIII. Segment XI vertical. Vulval scale long, bifid (Fig. 26).

Biology.— Larvae live in large rivers (preferred), smaller streams, lakes, and reservoirs. Gut contents are mainly fine particulate organic matter, but arthropods may be taken. The retreat is comprised of a silk-roofed depression on a rock; the floor of the depression is silk-covered; round holes occur at diametrically opposite sides of the roof; the roof is roughly 20 mm in diameter.

Cyrnellus is a New World genus, with only one species known from North America (eastern).

Cyrnellus fraternus (Banks)

Map 5; Fig. 2, 21–26

Cyrnellus fraternus Banks, 1905a:17; Betten, 1934:224 (= *vestitus*?); Milne, 1936:88 (as synonym of *Nyctiophylax vestitus*); Flint, 1971:29.

Nyctiophylax fraternus; Banks, 1907b:131; Ross, 1938a:12.

Cyrnellus fraternus; Flint, 1964:469; Flint, 1971:28; Wiggins, 1977:344; Schmid, 1980:Fig. 179–184.

Cyrnellus minimus Banks, 1913:88; Flint, 1967:6; Flint, 1971:29 (as synonym of *fraternus*).

Nyctiophylax marginalis Banks, 1930b:231; Ross, 1938a:12; Flint, 1964:469 (as synonym of *C. fraternus*).

Cyrnellus marginalis; Ross, 1944:71; Flint, 1964:469 (as synonym of *C. fraternus*).

Cyrnellus zernyi Mosely, 1934:142; Ross, 1938a:13 (as synonym of *Nyctiophylax marginalis*).

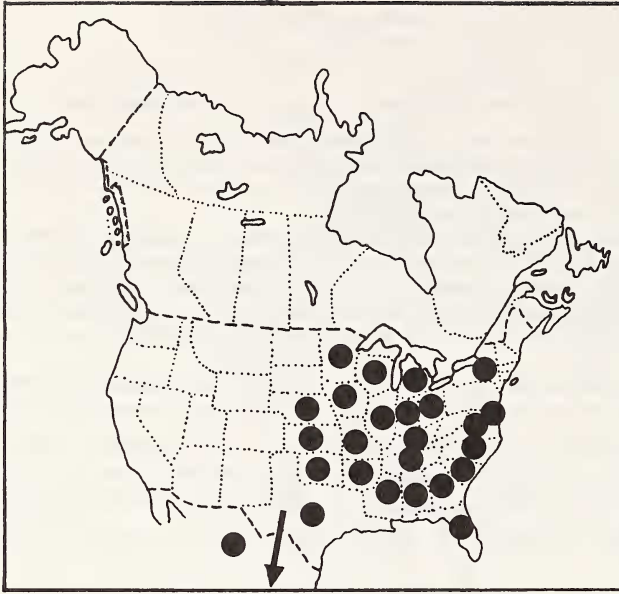
Description.— Fore-wing length of male 4.68 mm; very pale yellow-brown to straw; markings indefinite. Hind-wing very palely tinted straw, to hyaline. Antennae cream. Head pale yellow-brown. Spurs yellow; lateral spur of mid- and hind-leg pairs notably shorter than mesal companion. Segments of female mid-leg flattened. General body colour pale yellow-brown. Thoracic dorsum slightly darker, to pale red-brown.

Genitalia. Male. (Fig. 21–24). (Specimen from Reelfoot Lk, Lake Co., Tennessee, USA). Males of this species recognised, in lateral aspect (Fig. 21), by massive, lightly sclerotised segment X, with disto-ventral tooth; and, in ventral aspect (Fig. 23), by massive tooth on disto-mesal face of each clasper.

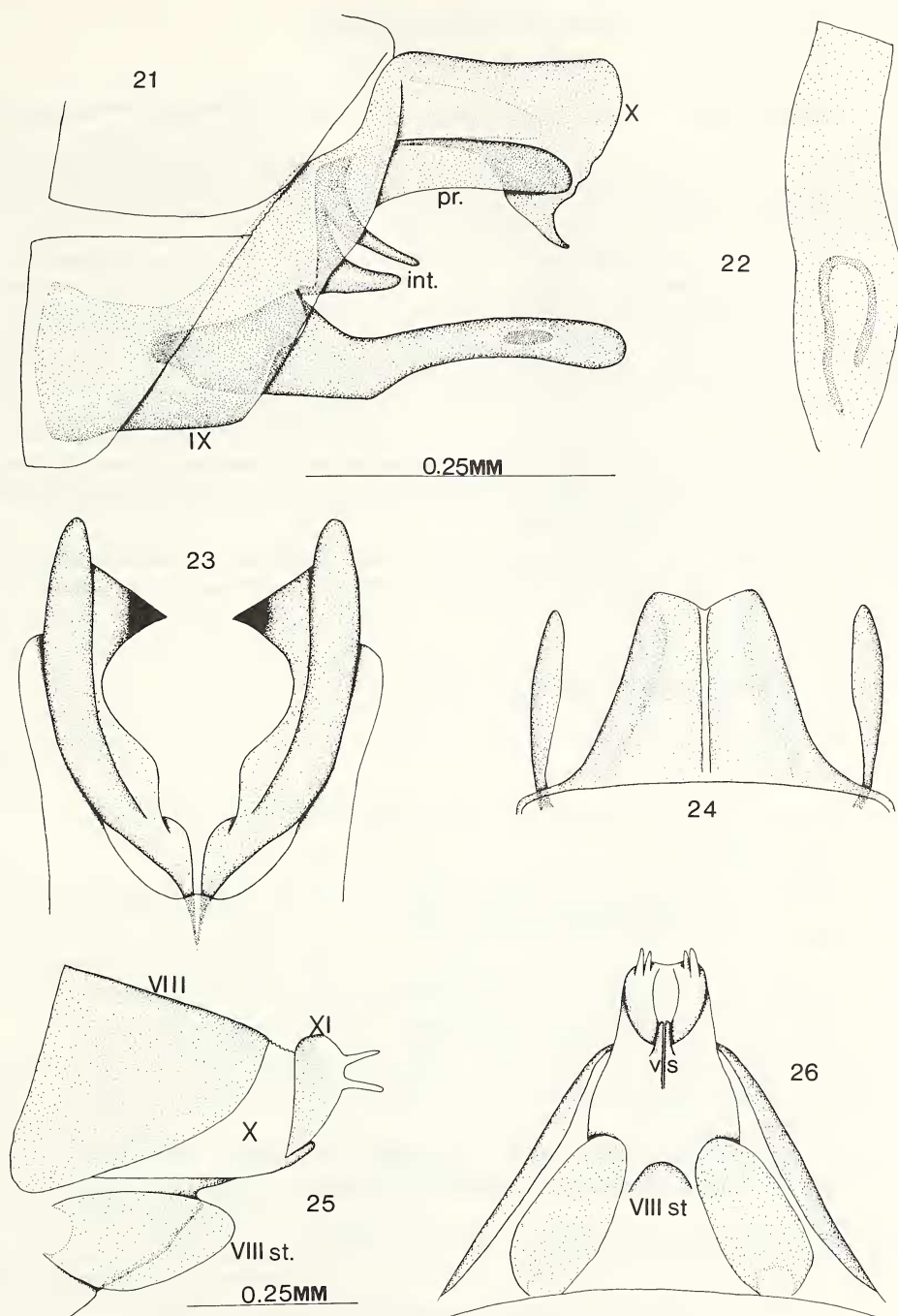
Genitalia. Female. (Fig. 25–26). (Specimen from Reelfoot Lk, Lake Co., Tennessee, USA). Females recognised by combination of general yellow-brown colouration of body; by large, ovoid lateral lobes of sternum VIII (Fig. 25); and by absence of cerci (only dorsal and ventral lobes of segment XI are evident).

Biology.— Ross (1944) records most collections from the larger rivers but, a few from smaller streams. Adult flight season in Illinois is May to October.

Distribution.— Not yet recognised from Canada, this species is otherwise very widespread. It has been recorded from Nebraska and Texas east to Florida and New York State, and north to Minnesota (map 5). It has also been recorded from Mexico south to the basin of the Amazon River in South America.



Map 5. Known distribution of *Cynellus fraternus* Banks in North America, by state.



Figs. 21-26. *Cyrellus fraternus* Banks: 21, genital capsule of male, lateral aspect; 22, aedeagus of male, lateral aspect; 23, genital capsule of male, ventral aspect; 24, segment X and preanal appendages of male, dorsal aspect; 25, genital segments of female, lateral aspect; 26, genital segments of female, ventral aspect. Legend: int. – intermediate appendage; pr. – preanal appendage; st. – sternum; vs. – vulval scale; VIII, IX, X, XI – body segments.

Genus *Neureclipsis* McLachlan

Maps 6–8; Fig. 3, 27–42

Neureclipsis McLachlan, 1864:26, 30; Betten, 1934:209; Milne, 1936:84; Ross, 1944:56; Wiggins, 1977:346; Schmid, 1980:65.

Description.— Basal two articles of maxillary palpus very short. Spur formula 3,4,4. Venation complete, little modified; fl–fV present on fore-wing; fl–fIII, and fV present on hind-wing. On fore-wing, cross-vein C–Sc absent. On hind-wing, discoidal cell closed; R1 diminished little, distinct from Sc to which it is united by a distinct cross-vein.

Genitalia. Male. (Fig. 27–30, 33–35, 38–40). Segment IX elongate (Fig. 27, 33). Segment X stout, in some species very long, semi-membranous. Preanal appendages free (Fig. 38), fused to bases of intermediate appendages (Fig. 27), or absent (Fig. 33). Intermediate appendages as long spines (Fig. 27), or reduced to simple buttons (Fig. 38); ventro-mesal angles in form of unbroken bridge dorsad of the aedeagus. Claspers (inferior appendages) very large, roughly horizontal, pincer-like (Fig. 28, 34, 39). Aedeagus large, with phallosome long, mostly enclosed ventrally; with membranous, distal endotheca (Fig. 29, 35, 40).

Genitalia. Female. (Fig. 31–32, 36–37, 41–42). Segment X small (Fig. 31). Lobes of sternum VIII large, well developed, not united (Fig. 32, 42). Vulval scale semi-membranous, sometimes carinate (Fig. 37).

Biology.— As filter feeders, the larvae are restricted to flowing waters, usually slower currents. The nets are large to very large. They may be stacked, on vegetation, from substrate to near the surface, for maximum utilisation of the water column. Food consists of animal and algal material. The nets are trumpet-shaped.

An Holarctic genus, *Neureclipsis* is represented in North America by five species, of which three concern us here (all being reported from Canada). One of these three is itself Holarctic in distribution.

Key to species of *Neureclipsis* McLachlan of Canada

- 1a Males (Fig. 27, 33, 38) 2
- 1b Females (Fig. 31) 4
- 2a (1a) Segment IX with antero-lateral edge produced far anterad, in lateral aspect (Fig. 33) *N. valida* (Walker), p. 159
- 2b Segment IX normal, not notably produced anterad (Fig. 27, 38) 3
- 3a (2b) Clasper, in lateral aspect (Fig. 27), narrow, tapered in stages; in ventral aspect (Fig. 28), with distal two-thirds narrow *N. bimaculata* (L.), p. 159
- 3b Clasper, in lateral aspect (Fig. 38), fairly wide, fairly evenly tapered to small, dorsally directed tip; in ventral aspect (Fig. 39), evenly tapered from base to narrow tip *N. crepuscularis* (Walker), p. 160
- 4a (1b) Lateral lobes of sternum VIII, in ventral aspect, narrow (Fig. 37) or wide and short (Fig. 32) 5
- 4b Lateral lobes of sternum VIII, in ventral aspect, large, with narrow base, greatly widened at mid-point, and reduced to dentate, rounded distal end (Fig. 42) *N. crepuscularis* (Walker), p. 160
- 5a (4a) Lateral lobe of sternum VIII, in lateral aspect (Fig. 31), short, square *N. bimaculata* (L.), p. 159
- 5b Lateral lobe of sternum VIII, in lateral aspect (Fig. 36), long, tapered *N. valida* (Walker), p. 159

Neureclipsis bimaculata (L.)

Map 6; Fig. 27–32

Phryganea bimaculata L., 1758:548.*Cyrnus bimaculatus*; Hagen, 1849:421.*Rhyncophila bimaculata*; de Motschulsky, 1853:76.*Neuroclipsis bimaculata*; Dziedzielewicz, 1867:163; (but *Neureclipsis* thereafter).*Neureclipsis bimaculata*; Betten, 1934:211; Milne, 1936:84, 88; Ross, 1944:57; Wiggins, 1977:346; Schmid, 1980:Fig. 158, 160–161.

There are six other specific epithets as synonyms, all European, all of short currency. See Fischer (1962:33–34) for details.

Description.— Fore-wing length of male 6.40 mm; dull brownish grey. Hind-wing tinted brownish grey distally. Female fore-wing golden brown; hind-wing tinted golden brown distally. Antennae drab grey; brownish yellow in female. Vertex of head deep red-brown. Spurs yellowish grey; lateral spur of mid-leg pairs notably shorter than mesal companion; lateral spur of male fore-leg apical pair minute (normal in female). Thorax deep red-brown, to brown laterally (golden brown in female). Legs straw; yellow in female.

Genitalia. Male. (Fig. 27–30). (Specimen from Slave R., Ft Smith, Northwest Territories). Males recognised by segment IX lateral wall not produced anterad to any great extent (Fig. 27); by clasper, in lateral aspect (Fig. 27), narrow, further narrowed in abrupt steps; and by intermediate appendages long, sinuate, blade-like, and tapered to acuminate tip.

Genitalia. Female. (Fig. 31–32). (Specimen from Sturgeon R., St Albert, Alberta). Females recognised primarily by short, wide, square-ended lateral lobe of sternum VIII in lateral aspect (Fig. 31); by the lateral lobes of sternum VIII, in ventral aspect (Fig. 32), short, squat; and by vulval scale narrow, with lateral edges clear of ventral edges of segment X.

Biology.— This species has been recorded (as adults) from the largest rivers of the north, to the smaller creeks of prairie and boreal forest. Records exist for the rapids sections of streams, and from lake outlets. Canadian flight season records range from May 28 to September 2.

Distribution.— Transcontinental from Nova Scotia to the lower Yukon River in western Alaska (map 6), and south to New Hampshire, Illinois, and Montana in the United States. This species is Holarctic, being known right through to the British Isles.

Neureclipsis valida (Walker)

Map 7; Fig. 33–37

Polycentropus validus Walker, 1852:100; Betten, 1934:221.*Neureclipsis valida*; Milne, 1936:84, 88 (as *validus*); Betten & Mosely, 1940:31; Ross, 1944:58.*Neureclipsis crepuscularis* non Walker; Betten, 1934:210.*Hydropsyche dubitans* Walker, 1852:113; Milne, 1936:61 (*incertae cedis*: seems to be a polycentropodid).*Polycentropus signata* Banks, 1892:367; Milne, 1936:88 (as synonym of *N. validus*); Ross, 1944:293 (as synonym of *N. validus*).

Description.— Fore-wing length of male 6.16 mm; uniform dull grey-brown. Hind-wing tinted very pale brown. Antennae brown; brownish cream in female. Vertex of head uniform red-brown; dark brown in female, with warts pale grey-brown. Spurs brown; lateral spur of mid-leg pairs notably shorter than mesal companion. Thorax dark red-brown, to paler laterally; dark brown in female. Legs brownish straw; straw in female.

Genitalia. Male. (Fig. 33–35). (Specimen from Ile Ste Hélène, St Lawrence R., Montréal, Québec). Males distinguished by lateral wall of segment IX produced far anterad, in lateral aspect (Fig. 33); by clasper with high dorsal hump at mid-point; and by intermediate appendage a very long, slender, distally acuminate blade inserted well anterad on antero-dorsal edge of segment IX.

Genitalia. Female. (Fig. 36–37). (Specimen from Costello Lk, Algonquin Provincial Park, Ontario). Females recognised by lateral lobe of segment X, in lateral aspect (Fig. 36), with narrow, sharply rounded distal half; by distal lobes of segment X, in ventral aspect (Fig. 37), long, narrow; and by vulval scale carinate – the keel with triangular anterior half, and with distal half pencil-like (Fig. 37).

Biology.— Inhabits much the same water types as *N. bimaculata*, above. Available Canadian flight season records range from May 29 to September 12.

Distribution.— Primarily a Canadian species, in the United States *N. valida* is presently known only from Minnesota and New York State. In Canada it has been recorded fairly extensively from central Saskatchewan to eastern Hudson's Bay and the Eastern Townships of

Québec (map 7).

Neureclipsis crepuscularis (Walker)

Map 8; Fig. 3, 38–42

Brachycentrus crepuscularis Walker, 1852:87.

Polycentropus crepuscularis; Hagen, 1861:292.

Neureclipsis crepuscularis; McLachlan, 1878:393; Milne, 1936:85, 88; Betten & Mosely, 1940:27; Ross, 1944:57; Schmid, 1980:Fig. 159, 162–164.

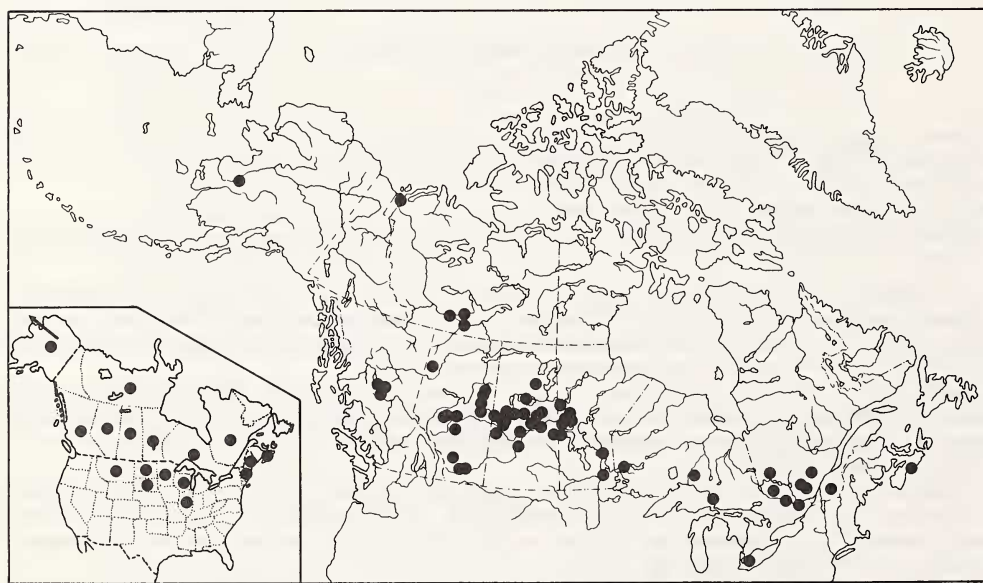
Neureclipsis parvula Banks, 1907c:163; Milne, 1936:88 (as synonym of *N. crepuscularis*); Betten & Mosely, 1940:29; Ross, 1944:293 (as synonym of *N. crepuscularis*).

Description.— Fore-wing length of male 5.64 mm; dull golden brown. Hind-wing palely tinted golden brown. Antennae dark brown. Vertex of head deep dull brown. Spurs grey-brown; lateral spur of mid-leg pairs, and hind-leg apical pair, notably shorter than mesal companion. Thorax deep brown, to grey-brown laterally. Legs grey-brown to grey. Female overall light orange-brown except thoracic dorsum dark brown.

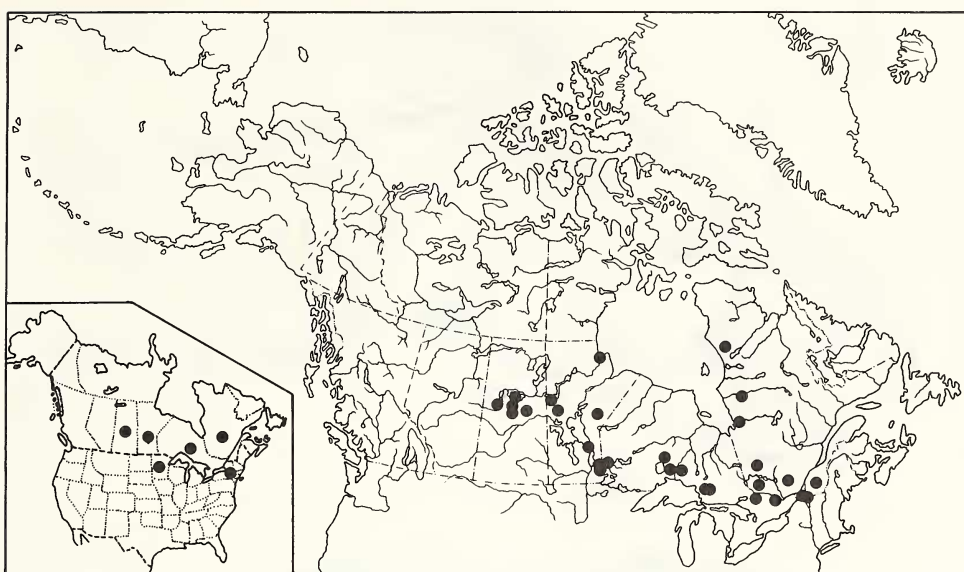
Genitalia. Male. (Fig. 38–40). (Specimen from Carrot Ck, Hwy 16, Carrot Creek, Alberta). Males recognised by lateral lobes of sternum VIII, in ventral aspect (Fig. 42), with narrow bases, widened greatly at mid-point, then narrowed distally to rounded, dentate distal edge; and by vulval scale lateral edges concealed by lateral lobes of sternum VIII.

Biology.— Adults emerge from small, sluggish creeks to larger, turbulent rivers. Flight season records from Canada range from June 5 to September 18.

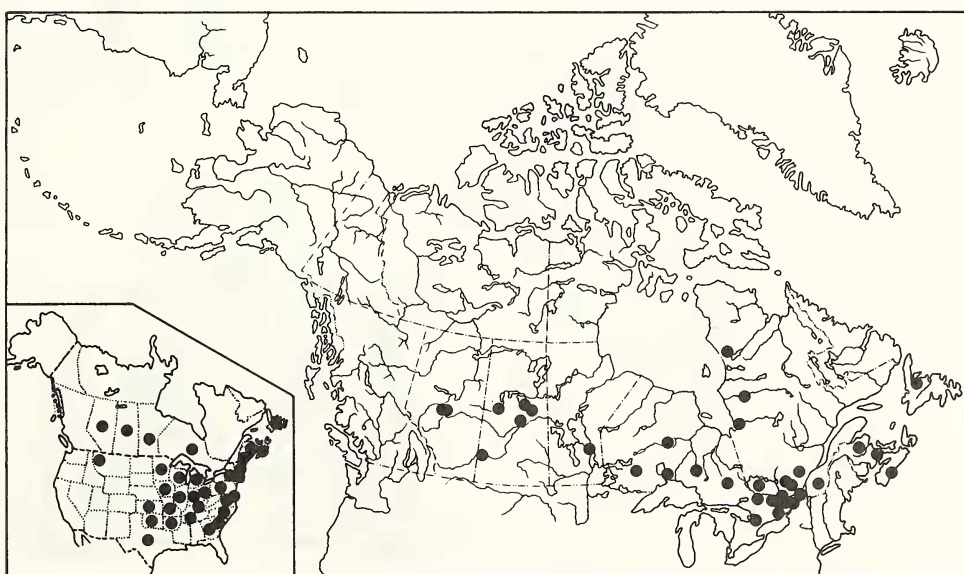
Distribution.— Widespread in eastern North America, with a western extension to Alberta and western Montana (map 8). In Canada it is recorded from central Alberta, in a narrow belt eastward to southern Québec, and with scattered records from the Atlantic Provinces and eastern Hudson's Bay.



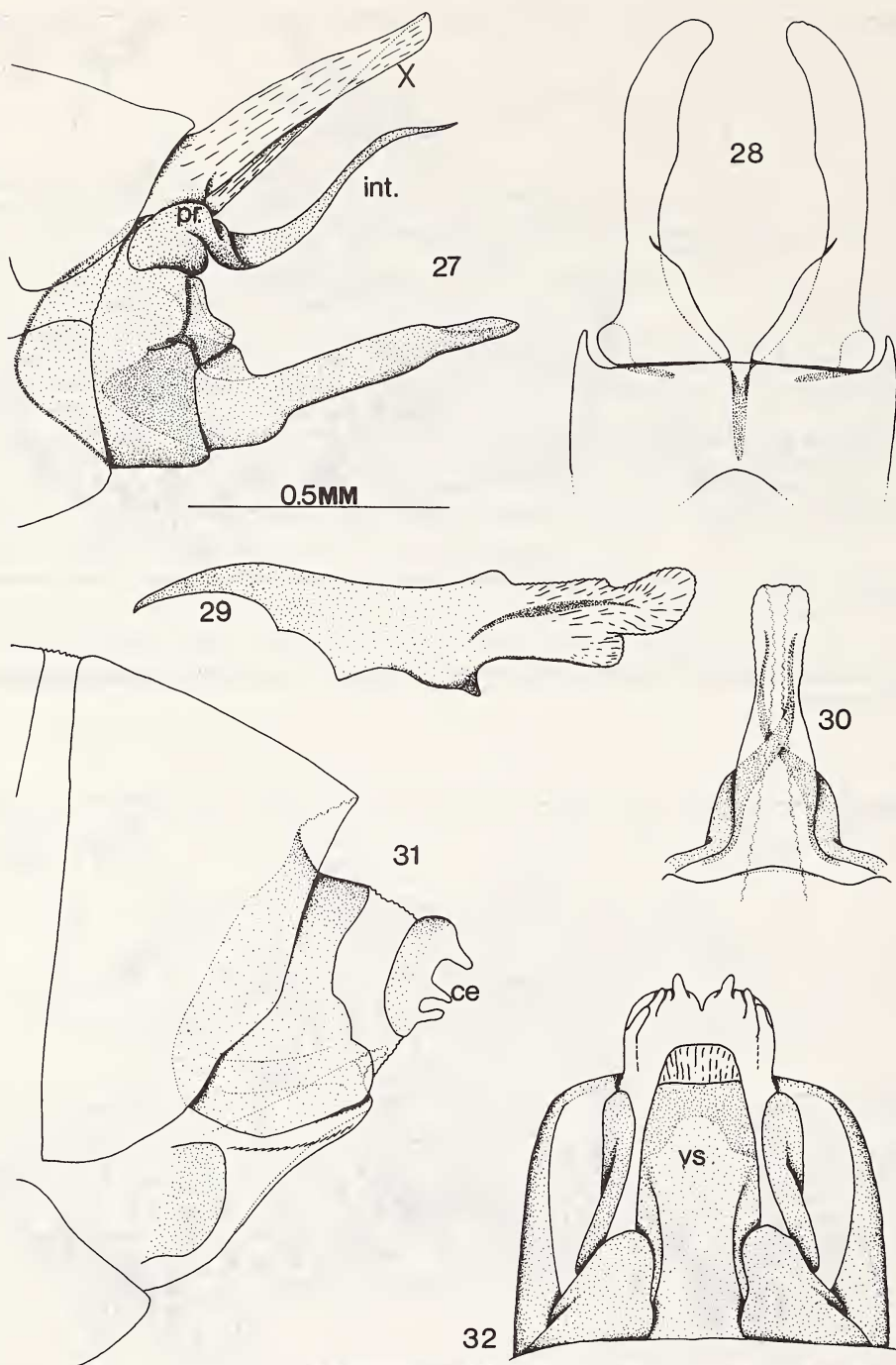
Map 6. Collection localities for *Neureclipsis bimaculata* (L.) in Canada and Alaska, with known distribution in North America by state or province.



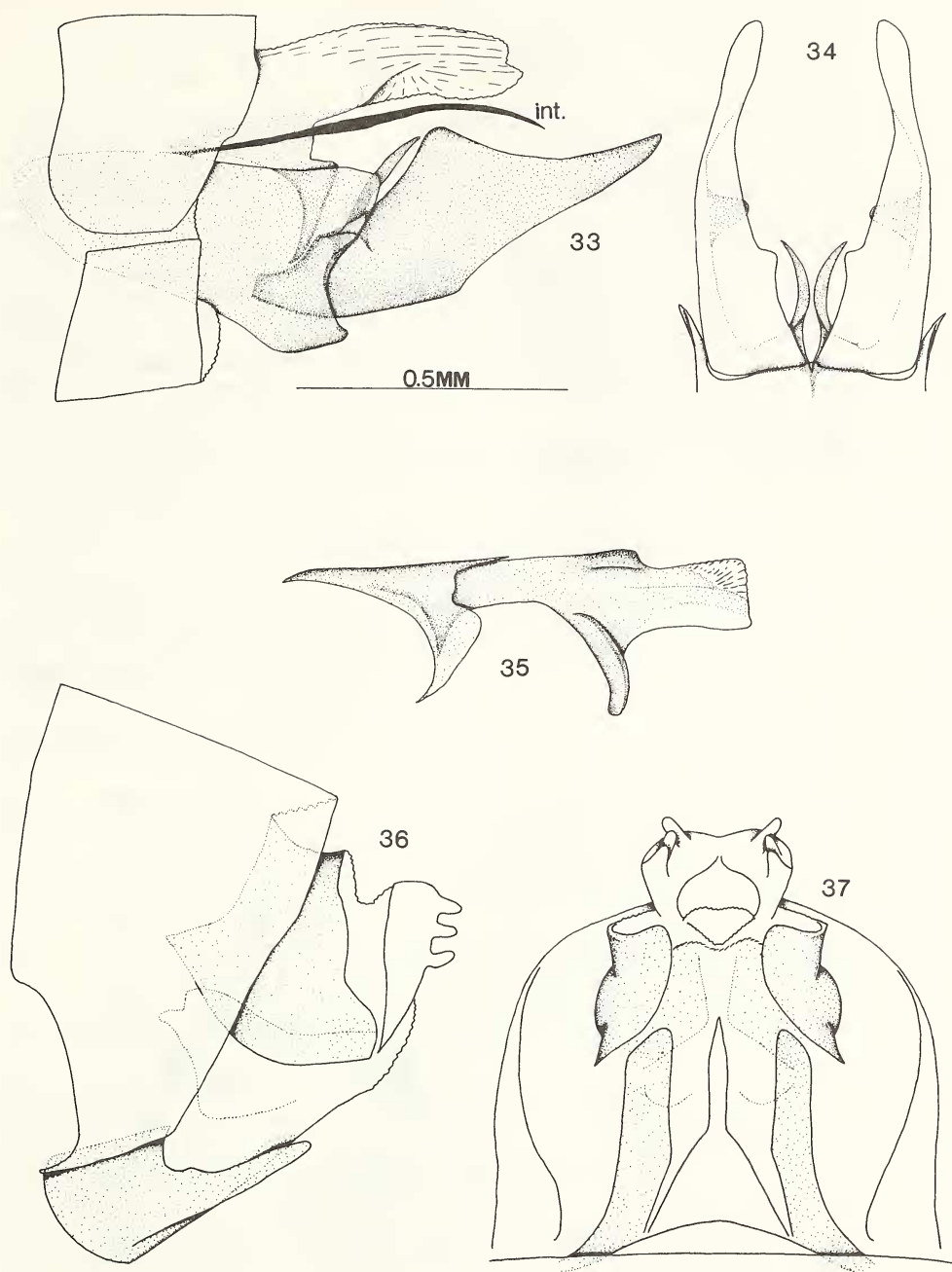
Map 7. Collection localities for *Neureclipsis valida* (Walker) in Canada, with known distribution in North America by state or province.



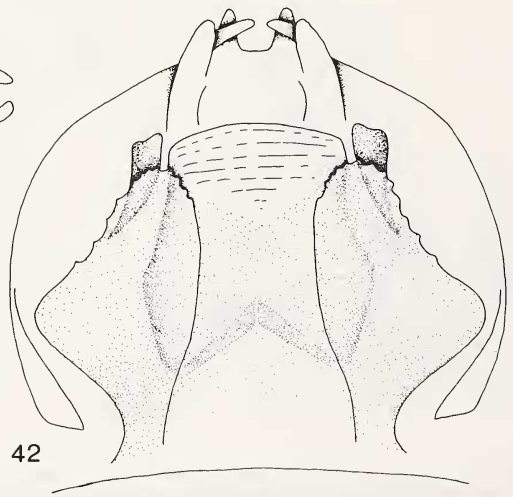
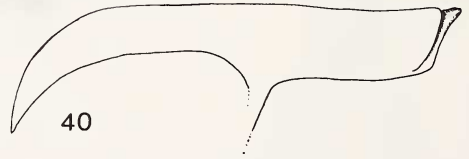
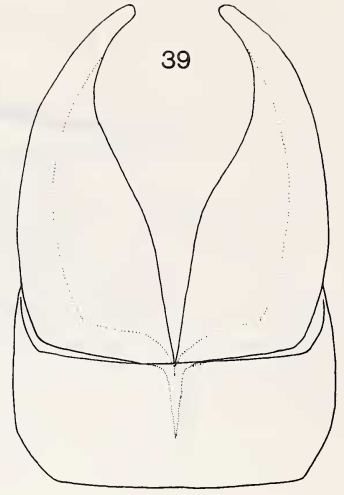
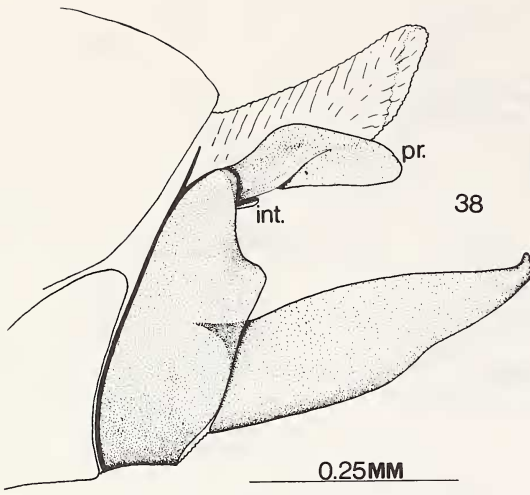
Map 8. Collection localities for *Neureclipsis crepuscularis* (Walker) in Canada, with known distribution in North America by state or province.



Figs. 27-32. *Neureclipsis bimaculata* (L.): 27, genital capsule of male, lateral aspect; 28, genital capsule of male, ventral aspect; 29, aedeagus of male, lateral aspect; 30, genital capsule of male, dorsal aspect; 31, genital segments of female, lateral aspect; 32, genital segments of female, ventral aspect. Legend: ce. – cercus; int. – intermediate appendage; pr. – preanal appendage; vs. – vulval scale; X – tergum X.



Figs. 33-37, *Neureclipsis valida* (Walker): 33, genital capsule of male, lateral aspect; 34, genital capsule of male, ventral aspect; 35, aedeagus of male, lateral aspect; 36, genital segments of female, lateral aspect; 37, genital segments of female, ventral aspect. Legend: int. – intermediate appendage.



Figs. 38-42, *Neureclipsis crepuscularis* (Walker): 38, genital capsule of male, lateral aspect; 39, genital capsule of male, ventral aspect; 40, aedeagus of male, lateral aspect; 41, genital segments of female, lateral aspect; 42, genital segments of female, ventral aspect. Legend: int. - intermediate appendage; pr. - preanal appendage.

Genus *Nyctiophylax* Brauer

Maps 9–13; Fig. 4, 43–60

Nyctiophylax Brauer, 1865:419; Betten, 1934:209, 224; Milne, 1936:83; Ross, 1944:69; Morse, 1972:172; Wiggins, 1977:348; Schmid, 1980:67.

Description.— Basal two articles of maxillary palpus very short. Spur formula 3,4,4. Venation (Fig. 4) slightly simplified by loss of fl on fore- and hind-wings, and of fIII on hind-wing. Fore-wing with discoidal cell very long; the three anal veins in form of two markedly convex lenses, without cross-veins, terminated almost at the one point. Hind-wing with Sc thickened slightly; R1 very slender, these two veins fused for a short distance; discoidal cell very short, triangular.

Genitalia. Male. (Fig. 43–45, 48–60). Very uniform within the genus. Segment IX robust, only half as high as the abdomen (Fig. 43). Segment X small, membranous, always with some sclerotisation. Preanal appendages very large, slightly projected posterad, hardly indented. Intermediate appendages spur-like, curved postero-ventrad, inserted on ventro-mesal face of preanal appendages, connected mesally as bridge dorsad of aedeagus. Claspers (inferior appendages) not prominent, produced mesad, with ventral and two dorsal lobes (Fig. 44). Aedeagus (Fig. 57) with phallosome reduced, slightly sclerotised; endotheca long, cylindrical, with two long, basal spines (not parameres), the whole terminated by large, erectile lobe with minute spines within folds.

Genitalia. Females. (Fig. 46–47). Lateral lobes of sternum VIII small, almost separated but attached to and connected by body of sternum. Segment X simple, high, with ventral extremities adjacent to each other (Fig. 47). Vulval scale small. Segment XI short, high.

Biology.— Larvae are carnivorous, living in lakes, and pools of streams. Retreats are simple, silken roofs over depressions in solid substrates (wood, rock); under this roof is a cylindrical chamber open at both ends.

Nyctiophylax is recorded from all regions but Europe, for a total of 23 extant species (Morse, 1972). Wiggins (1977) tallies eight species known from North America, five of which concern us here.

Key to species of *Nyctiophylax* Brauer of Canada

- 1a Males (Fig. 43) 2
- 1b Females (Fig. 46). Not keyed further as no reliable characters have yet been found to separate females of the species recorded here.
- 2a (1a) Dorso-mesal lobe of clasper, in ventral aspect, curved postero-mesad (Fig. 56) *N. moestus* Banks, p. 167
- 2b Lobe not so curved; directed posterad (Fig. 44, 53) or curved postero-laterad (Fig. 50, 60) 3
- 3a (2b) Dorso-mesal lobe of clasper, in ventral aspect, curved postero-laterad (Fig. 50, 60) 4
- 3b Lobe directed posterad (Fig. 44, 53) 5
- 4a (3a) Tergum X, in lateral aspect, large, sclerotised (Fig. 48) *N. banksi* Morse, p. 166
- 4b Tergum X slightly sclerotised ventrally (Fig. 58) *N. uncus* Ross, p. 167
- 5a (3b) Dorso-mesal lobe of clasper, in ventral aspect, rectangular (Fig. 53) *N. celta* Denning, p. 166
- 5b Lobe tapered, more or less pointed distally (Fig. 44) *N. affinis* (Banks), p. 166

Nyctiophylax affinis (Banks)

Map 9; Fig. 43–47

Polycentropus affinis Banks, 1897:30.*Nyctiophylax affinis*; Martynov, 1910:407; Betten, 1934:224 (as synonym of *N. vestitus* ?); Milne, 1936:88 (synonym of *N. vestitus*); Morse, 1972:176; Wiggins, 1977:Fig. 264E.*Nyctiophylax vestitus* Hagen; (In error – see Morse (1972:176, 180)); Betten, 1934:225; Milne, 1936:83, 88; Ross, 1944:70.*Nyctiophylax zelenus* Denning, 1950:99; Morse, 1972:176 (as synonym of *N. affinis*).

Description.— Fore-wing length of male 5.15 mm; dull golden brown, no pattern evident. Hind-wing tinted pale golden brown. Antennae pale yellow-brown; flagellar annuli with or without dark bands. Vertex of head brown. Spurs yellow; lateral spur of each mid-leg pair notably shorter than mesal companion. Thorax red-brown, to yellow-brown laterally. Legs brown.

Genitalia. Male. (Fig. 43–45). (Specimen from Ile Ste Hélène, St Lawrence R., Montréal, Québec). Males distinguished by preanal appendage, in lateral aspect (Fig. 43), truncate, resulting straight edge dentate; by intermediate appendage slightly arched dorsad, tapered distad, with tip slightly, if any, lower than base; and by disto-mesal lobe of clasper, in ventral aspect (Fig. 44), directed posterad, not quite acuminate.

Genitalia. Female. (Fig. 46–47). (Specimen from Ile Ste Hélène, St Lawrence R., Montréal, Québec). Females of all species as in Fig. 46–47. No characters have yet been discovered whereby to separate them. Characters to separate these females from those of other genera are recorded under *Nyctiophylax*.

Biology.— This species apparently inhabits a variety of streams and smaller and larger rivers, and lakes. Canadian flight season records range from June 5 to August 25.

Distribution.— Widespread east of a line from Manitoba to Texas (map 9). In Canada this species has been recorded from Newfoundland west to British Columbia, with no records from Alberta, where it is anticipated that it will eventually be found in the boreal forest streams of the northern half of that Province. In Canada, at least, it seems to exhibit a marked avoidance of the streams of the open prairie.

Nyctiophylax banksi Morse

Map 10; Fig. 4, 48–50

Nyctiophylax banksi Morse, 1972:173.

Description.— Fore-wing length of male 5.19 mm; pale grey-brown. Hind-wing tinted grey-brown. Antennae yellow-brown; basal 13 flagellar annuli each with dark ring at two-thirds distance from base of each annulus. Vertex of head light red-brown. Spurs straw; lateral spurs subequal to mesal companions. Thorax light red-brown, to yellow-brown laterally.

Genitalia. Male. (Fig. 48–50). (Specimen from Lac Monroe, Parc Mont Tremblant, Québec). Males recognised by segment X largely sclerotised (Fig. 48); by intermediate appendage, in lateral aspect (Fig. 48), curved evenly and completely ventrad, evenly tapered distad to rounded tip; and by disto-mesal lobe of clasper directed postero-laterad in ventral aspect (Fig. 50).

Genitalia. Female. See remarks under *N. affinis* above.

Biology.— Little known. The few records for this species provide a minimum flight season of June 23 to August 3.

Distribution.— Scattered records from Minnesota to Tennessee, South Carolina, Maine, southern Québec, and eastern Ontario (map 10). In Canada there are a total of five records from eastern Ontario, and southern Québec.

Nyctiophylax celta Denning

Map 11; Fig. 51–53

Nyctiophylax celta Denning, 1947:251; Morse, 1972:173.

Description.— Fore-wing length of male 5.85 mm; grey-brown. Hind-wing hyaline, with faint tinting. Antennae yellow; basal 14 flagellar annuli each with dark ring two-thirds of distance from base. Vertex of head red-brown. Spurs

yellow; lateral spur of mid- and hind-leg pairs notably shorter than mesal companion. Thorax red-brown. Legs straw.

Genitalia. Male. (Fig. 51–53). (Specimen from Lac Monroe, Parc Mont Tremblant, Québec). Males distinguished by segment X sclerotised along each ventro-lateral face (Fig. 51); by preanal appendage, in lateral aspect, truncate distally, straight edge not modified; by intermediate appendage of more or less uniform width throughout, bent sharply postero-ventrad at one-third distance from base; and by dorsal lobes of clasper, in ventral aspect (Fig. 53), of equal length, disto-mesal lobe rectangular.

Genitalia. Female. See comments under *N. affinis* above.

Biology.— Little known. Records of flight season from Canada range from June 6 to August 29.

Distribution.— From Minnesota to Florida and Maine (map 11). In Canada, three records, from southern Québec and eastern Ontario.

Nyctiophylax moestus Banks

Map 12; Fig. 54–57

Nyctiophylax moestus Banks, 1911:359; Betten, 1934:226; Milne, 1936:83, 88; Ross, 1938a:13 (as synonym of *N. vestitus*); Morse, 1972:176; Schmid, 1980:Fig. 173–178.

Nyctiophylax vestitus; Ross, 1944:70.

Description.— Fore-wing length of male 7.02 mm; uniform translucent brownish grey. Hind-wing slightly tinted distally about veins C to R5. Antennae pale grey-brown; basal 13 flagellar annuli each with dark brown ring. Vertex of head pale brown. Spurs yellow; lateral spur of each mid- and hind-leg pair notably shorter than mesal companion. Thorax red-brown, to paler laterally. Legs dull straw.

Genitalia. Male. (Fig. 54–57). (Specimen from North Heart R., Hwy 2, Nampa, Alberta). Males recognised by light sclerotisation of lateral wall of segment X (Fig. 54); by preanal appendage distally rounded; by intermediate appendage small, directed postero-ventrad, slightly curved, evenly tapered distad; and by disto-mesal lobe of clasper, in ventral aspect (Fig. 56), curved postero-mesad.

Genitalia. Female. See remarks under *N. affinis* above.

Biology.— Little known. The Canadian flight season extends at least from June 3 to August 29.

Distribution.— Transcontinental (map 12), south in the United States to Tennessee and Oregon. In Canada it has been recorded from Cape Breton Island to Vancouver Island, excepting Manitoba, and north well into the boreal forest.

Nyctiophylax uncus Ross

Map 13; Fig. 58–60

Nyctiophylax uncus Ross, 1944:70; Morse, 1972:173.

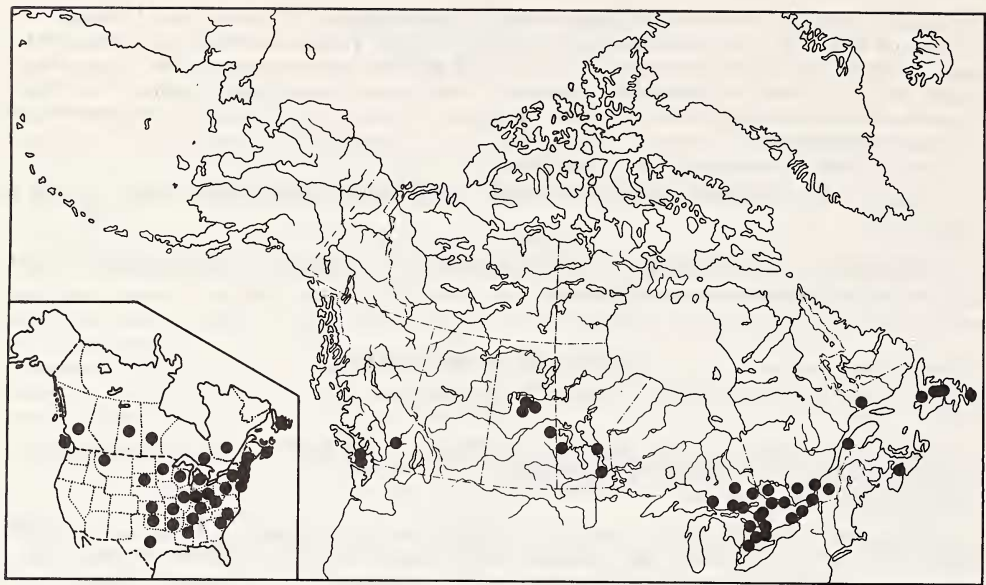
Description.— Fore-wing length of male 6.08 mm; very pale grey-brown. Hind-wing hyaline. Antennae straw; basal 14 flagellar annuli each with dark ring. Vertex of head deep red-brown. Spurs pale yellow-brown. Thorax deep red-brown. Legs yellow-brown.

Genitalia. Male. (Fig. 58–60). (Specimen from Mistassini, Québec). Males distinguished by segment X slightly sclerotised ventro-mesally (Fig. 58, 59); by preanal appendage broadly rounded distally, in lateral aspect (Fig. 58); by intermediate appendage directed posterad, with distal one-third curved ventrad to rounded tip; and by disto-mesal dorsal lobe of clasper long, thin, directed posterad but with tip curved laterad, in ventral aspect (Fig. 60) – disto-lateral companion lobe short, very large, rounded.

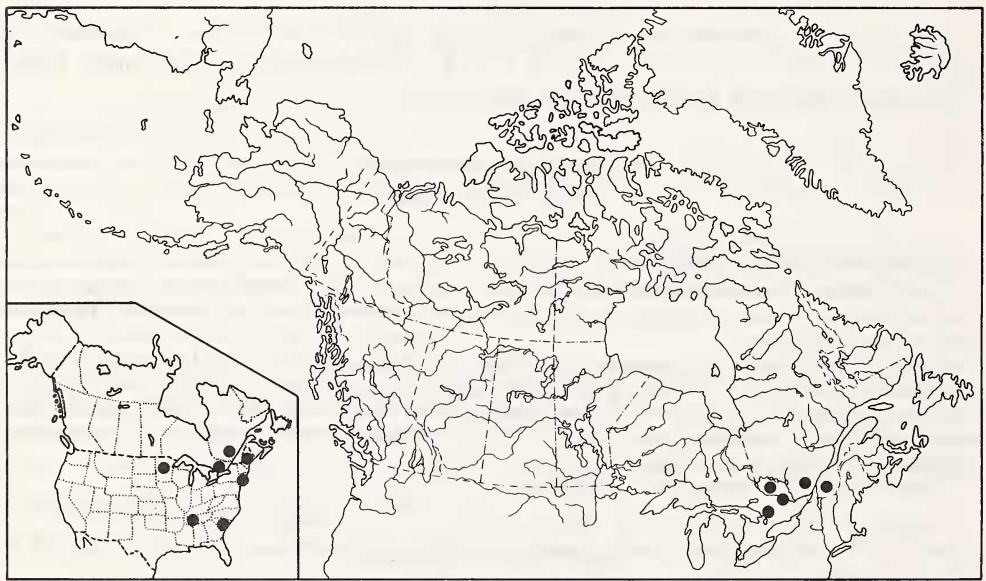
Genitalia. Female. See remarks under *N. affinis* above.

Biology.— The very few flight dates available for this species range from June 16 to September 7. The even fewer locality records which give any indication of habitat occupied by the larvae have all been lakes.

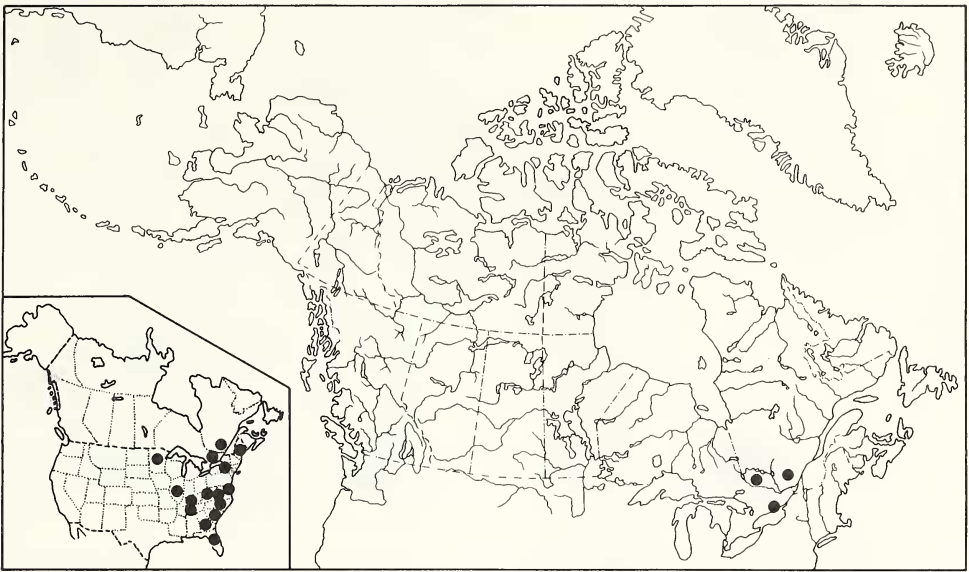
Distribution.— From Michigan to Tennessee, east to Maine, and north to James Bay (Fig. 13). In Canada there are sparse records from southern Québec and Ontario.



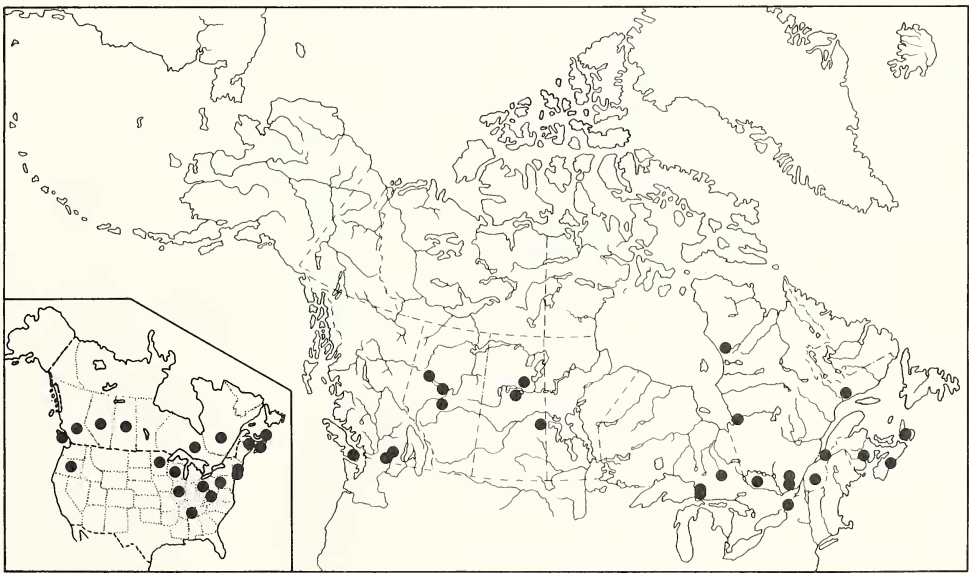
Map 9. Collection localities for *Nyctiophylax affinis* (Banks) in Canada, with known distribution in North America by state or province.



Map 10. Collection localities for *Nyctiophylax banksi* Morse in Canada, with known distribution in North America by state or province.



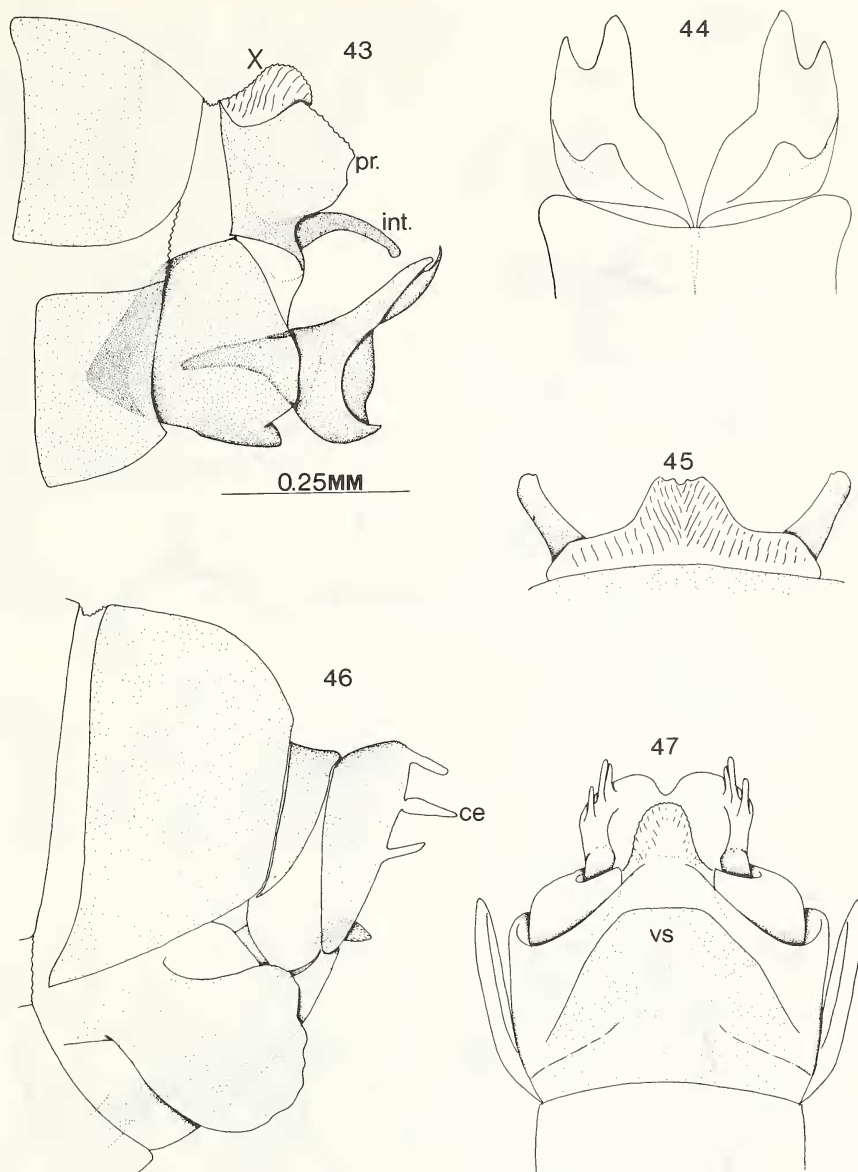
Map 11. Collection localities for *Nyctiophylax celta* Denning in Canada, with known distribution in North America by state or province.



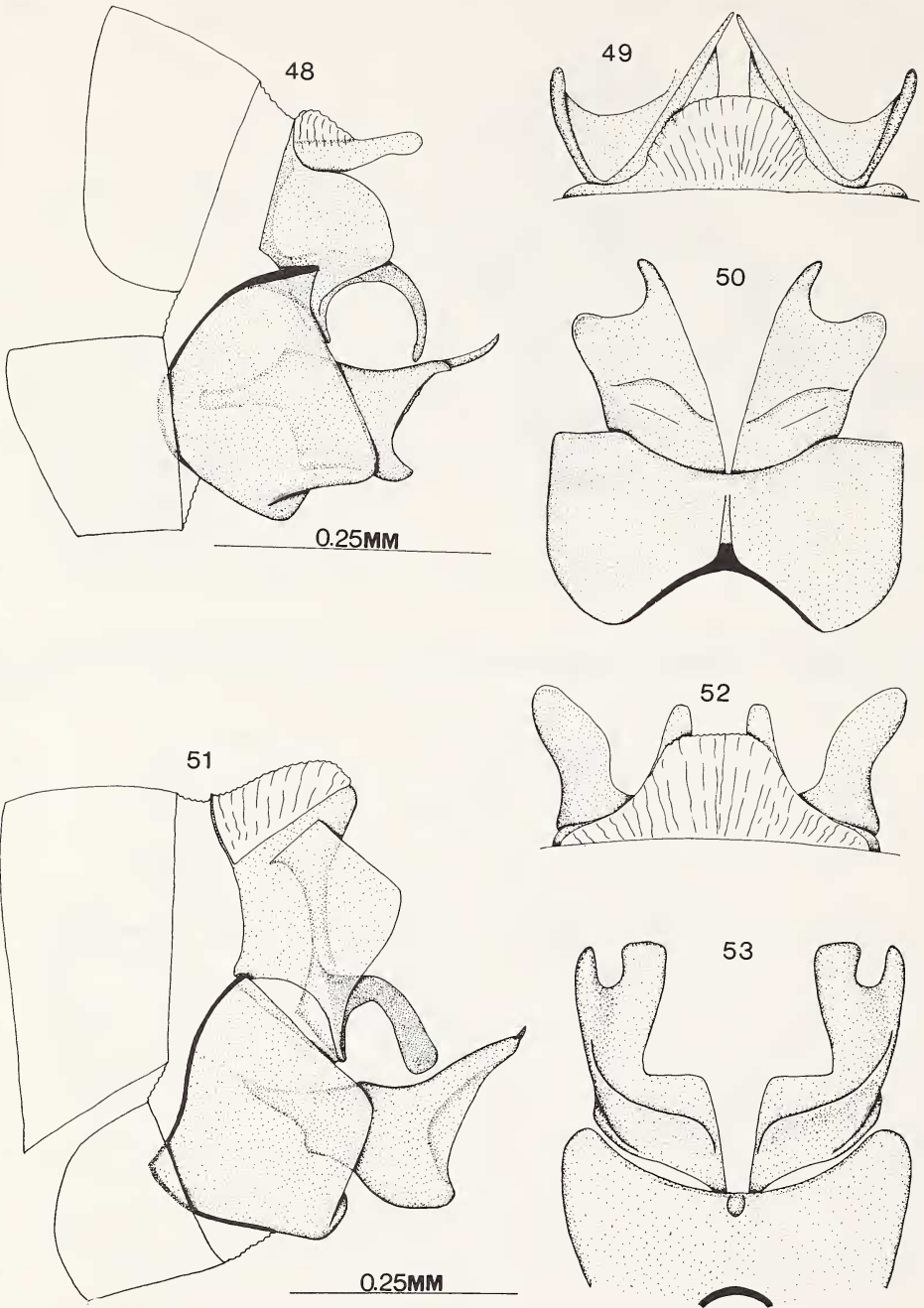
Map 12. Collection localities for *Nyctiophylax moestus* Banks in Canada, with known distribution in North America by state or province.



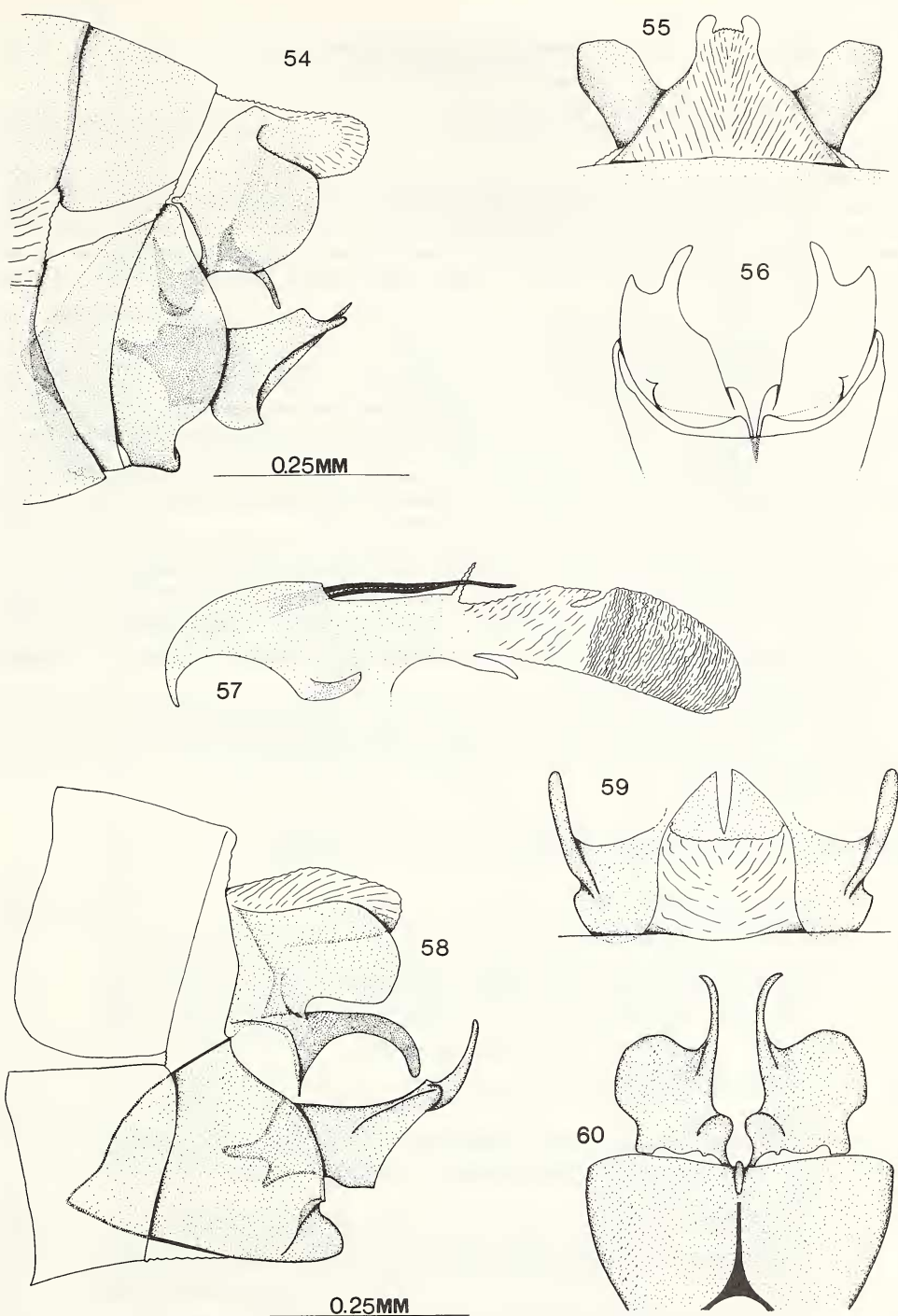
Map 13. Collection localities for *Nyctiophylax uncus* Ross in Canada, with known distribution in North America by state or province.



Figs. 43-47, *Nyctiophylax affinis* (Banks): 43, genital capsule of male, lateral aspect; 44, genital capsule of male, ventral aspect; 45, segment X and preanal appendages of male, dorsal aspect; 46, genital segments of female, lateral aspect; 47, genital segments of female, ventral aspect. Legend: ce. cercus; int. – intermediate appendage; pr. – preanal appendage; vs. – vulval scale; X – tergum X.



Figs. 48-53. 43-50, *Nyctiophylax banksi* Morse: 48, genital capsule of male, lateral aspect; 49, genital capsule of male, dorsal aspect; 50, genital capsule of male, ventral aspect. 51-53, *Nyctiophylax celta* Denning: 51, genital capsule of male, lateral aspect; 52, genital capsule of male, dorsal aspect; 53, genital capsule of male, ventral aspect.



Figs. 54-60. 54-57, *Nyctiophylax moestus* Banks: 54, genital capsule of male, lateral aspect; 55, genital capsule of male, dorsal aspect; 56, genital capsule of male, ventral aspect; 57, aedeagus of male, lateral aspect. 58-60, *Nyctiophylax unicus* Ross: 58, genital capsule of male, lateral aspect; 59, genital capsule of male, dorsal aspect; 60, genital capsule of male, ventral aspect.

Genus *Polycentropus* Curtis
Maps 14–46; Fig. 5, 61–261

Polycentropus Curtis, 1835:plate 544; Betten, 1934:220; Milne, 1936:85; Ross, 1944:58; Wiggins, 1977:352; Schmid, 1980:65.

Description.— Maxillary palpi with basal two articles very short. Spur formula 3,4,4. Venation (Fig. 5) slightly simplified, weakly modified. Fore-wing fl–fV present. Hind-wing with fl, fII, and fV, or fII and fV present. Fore-wing with cross-veins C–Sc, Sc–R1, and R1–R2 present. Hind-wing with slight sexual dimorphisms; slightly larger, with distal veins more divergent in males; sub-costal cell very large; Sc thickened; R1 and M very slender; Sc and R1 united at point prior to distal extremities, then strongly divergent; If present or absent; discoidal cell open or closed; and cross-vein Cu2–A1 sometimes present.

Genitalia. Male. (Fig. 61–65, 97–100, 111–114, 167–170, 188–191, 221–224, 234–237, 245–249, 250–253, 256–259). Highly varied, depending on species group. Segment IX robust laterally (Fig. 61, *etc.*) and ventrally, some species with postero-ventral edge projected as ledge or bulbous process (see Fig. 97, and especially 167). Segment X small, membranous, almost absent in some species, rarely even slightly sclerotised. Preanal appendages generally small, free, in some species fused to bases of intermediate appendages. Intermediate appendages small in some species; in others, as large, postero-ventrally curved arch (Fig. 193); with ventro-mesal edge produced mesad in form of bridge (complete or not) dorsad of aedeagus; in some species with sinuate spine basally. Claspers (inferior appendages) varied in size; bilobed in some fashion. Aedeagus also quite varied: in some species short phallosome and almost vestigial endotheca, with distal membranous lobe (Fig. 210); in others, distal lobe absent, and endotheca clearly developed and spinate (Fig. 137); in other groups aedeagus is complex distally, and relationships of parts unclear (Fig. 100).

Genitalia. Female. (Fig. 66–67). Segment X small (Fig. 66). Lateral lobes of sternum VIII well separated (Fig. 67), not united. Vulval scale very large, in some species carinate. Roof of ano-vaginal aperture in some species sclerotised.

Biology.— Principally predaceous, larvae of this genus inhabit most fresh waters, including even temporary vernal pools. They appear able to cope with warm standing waters, an unusual feature within the family. Being predaceous, they do not use a net, and the retreat is a simple silken tube anchored to the substrate.

Polycentropus, in the widest sense, is known from all but the Australasian region, being represented by a multitude of species. Forty species are recorded from north of Mexico, of which 33 concern us here.

Key to known or potential species of *Polycentropus* Curtis of Canada

- | | | |
|---------|---|----|
| 1a | Females (Fig. 66–67, <i>etc.</i>) | 34 |
| 1b | Males (Fig. 61–65, <i>etc.</i>) | 2 |
| 2a (1b) | Preanal appendage with dorsal edge produced as long, slender, distally acuminate, blade-like rod (in lateral aspect) curved (evenly or not) dorsad then postero-ventrad (Fig. 111, 117, 127, 147), or recurved (Fig. 140) | 3 |
| | Group C, p. 195 | 3 |
| 2b | Preanal appendages otherwise (e.g. Fig. 61, 97, 167, 188, 211, 234, 245, 250) | 11 |
| 3a (2a) | Clasper, in ventral aspect, with dorsal lobe not visible (Fig. 113, 142, 163) | 4 |
| 3b | Dorsal lobe of clasper visible laterally or mesally from below (Fig. 119, 125, 129, 134, 149, 155) | 6 |
| 4a (3a) | Dorsal lobe of clasper, in lateral aspect (Fig. 160), with posterior margin curved ventrad to small point located near junction of dorsal and ventral lobes | 5 |
| | <i>P. pentus</i> Ross, p. 198 | |
| 4b | Dorsal lobe of clasper, in lateral aspect (Fig. 11, 140), with point located distally as part of swollen tip | 5 |
| 5a (4b) | Process of preanal appendage recurved, tip directed posterad in lateral aspect (Fig. 140) | 5 |
| | <i>P. elarus</i> Ross, p. 197 | |

5b	Process of preanal appendage not recurved, with tip directed postero-ventrad in lateral aspect (Fig. 111)	
	. . . . . <i>P. blicklei</i> Ross & Yamamoto, p. 195	
6a (3b)	Clasper, in ventral aspect, with dorsal lobe exposed to view laterad of ventral lobe (Fig. 129, 134, 155)	7
6b	Dorsal lobe exposed to view mesad of ventral lobe (Fig. 119, 125, 149)	9
7a (6a)	Ventral lobe of clasper, in ventral aspect (Fig. 134), of more or less uniform width, finger-like	
	. . . . . <i>P. confusus</i> Hagen, p. 196	
7b	Ventral lobe triangular (Fig. 129, 155)	8
8a (7b)	Dorsal lobe of clasper, in lateral aspect (Fig. 127), with triangular, disto-ventral point	
	. . . . . <i>P. centralis</i> Banks, p. 196	
8b	Dorsal lobe without point (Fig. 153)	
	. . . . . <i>P. neiswanderi</i> Ross, p. 197	
9a (6b)	Dorsal process of preanal appendage, in lateral aspect (Fig. 147), very long, extended approximately to ventral lobe of clasper	
	. . . . . <i>P. maculatus</i> Banks, p. 197	
9b	Dorsal process shorter, hardly extended to dorsal lobe of clasper (Fig. 117, 122)	10
10a (9b)	Clasper, in ventral aspect (Fig. 125), with ventral lobe evenly tapered posterad, with broad, slightly rounded, blunt tip	
	. . . . . <i>P. pixi</i> Ross, p. 198	
10b	Clasper ventral lobe, in ventral aspect (Fig. 119), irregular, fairly abruptly narrowed at mid-point, to finger-like distal half curved slightly mesad	
	. . . . . <i>P. carolinensis</i> Banks, p. 195	
11a (2b)	Intermediate appendage with dorsal edge produced as blade-like structure of varied length and curvature, curved dorsad then postero-ventrad, in lateral aspect (Fig. 186, 188, 193, 200, 207, 213, 216). Preanal appendage, in lateral aspect, in most species, with appearance of being composed of two articles. Clasper, in lateral aspect, in most species, with meso-dorsal lobe folded meso-ventrad	12
	. . . . . Group E, p. 218	
11b	Species showing not more than one of these characters, or none	18
12a (11a)	Tip of intermediate appendage projected well posterad of tip of preanal appendage, in lateral aspect (Fig. 193, 200, 213).	13
12b	Tips coincident, or intermediate appendage apparently shorter than preanal appendage (Fig. 186, 188, 207, 216)	15
13a (12a)	Preanal appendage without apparent distal article (Fig. 200)	
	. . . . . <i>P. glacialis</i> Ross, p. 219	
13b	Preanal appendage with apparent distal article.	14
14a (13b)	Postero-dorsal angle of clasper with distinct, deep notch, in lateral aspect, at base of mesal lobe which tends to obscure notch from behind (Fig. 213)	
	. . . . . <i>P. melanae</i> Ross, p. 220	
14b	Notch absent (Fig. 193)	
	. . . . . <i>P. flavus</i> (Banks), p. 216	
15a (12b)	Posterior edge of segment IX, in ventral aspect (Fig. 187), with pair of deep, broad notches, produced as distinct w-shaped outline	
	. . . . . <i>P. chellus</i> Denning, p. 216	
15b	Posterior edge of segment IX with only slight shallow depressions on edge (Fig. 191, 209, 219)	16
16a (15b)	Intermediate appendage, in lateral aspect (Fig. 188), with distinct,	

	smoothly curved, ventral secondary process clearly visible	
	..... <i>P. grellus</i> Milne, p. 219	
16b	Secondary process absent (Fig. 216), or only small, rod-like process inserted on mesal surface of appendage (Fig. 207)	17
17a (16b)	Intermediate appendage shorter than preanal appendage in lateral aspect (Fig. 216)	<i>P. milaca</i> Etnier, p. 220
17b	Both appendages with tips coincident (Fig. 207)	<i>P. interruptus</i> (Banks), p. 219
18a (11b)	Postero-ventral edge of segment IX, in lateral aspect, with distinct projection posterad (Fig. 97, 103, 167, 173, 179). (Projections as in Fig. 61, 227, 250 not of account here)	19
18b	Projections absent (except very minor ones (Fig. 61, 227, 250))	23
19a (18a)	Postero-ventral process of segment IX tubular, short (Fig. 103) or long (Fig. 97), with rounded tip	Group B, p. 190
19b	Process shelf-like, acuminate in lateral aspect (Fig. 167, 173, 179)	Group D, p. 212
20a (19a)	Postero-ventral process of segment IX, in lateral aspect (Fig. 97), as long as clasper. Aedeagus with several stout, dark spines (Fig. 100)	<i>P. clinei</i> (Milne), p. 190
20b	Postero-ventral process much shorter than clasper (Fig. 103). Aedeagus without spines (Fig. 107)	<i>P. weedi</i> Blickle & Morse, p. 190
21a (19b)	Postero-ventral process of segment IX, in lateral aspect (Fig. 173), with obvious mesal carina on dorsal surface	<i>P. crassicornis</i> Walker, p. 212
21b	Carina not visible in lateral aspect (Fig. 167, 179)	22
22a (21b)	Intermediate appendage bifid, in lateral aspect, with both lobes projected posterad beyond remaining appendages of genitalia (Fig. 167), of roughly equal length	<i>P. aureolus</i> (Banks), p. 212
22b	Intermediate appendage bifid, with dorsal lobe curved latero-anterad (Fig. 179), much shorter than ventral lobe	<i>P. jenula</i> Denning, p. 213
23a (18b)	Ventro-mesal face of preanal appendage, in lateral aspect, with at least one sclerotised lobe, in most specimens hooked ventrad distally (Fig. 68), or linear (Fig. 83), or sinuate (Fig. 61)	Group A, p. 179
23b	Ventro-mesal face without such lobes (Fig. 221, 227, 234, 250, 256)	28
24a (23a)	Ventro-mesal lobe of preanal appendage linear (Fig. 83), or sinuate in lateral aspect	25
24b	Lobe distally hooked ventrad (Fig. 68, 76, 90)	26
25a (24a)	Ventro-mesal lobe of preanal appendage sinuate in lateral aspect (Fig. 61). Intermediate appendage curved dorsad; tips recessed, with distinct spine each (Fig. 62)	<i>P. albipunctus</i> (Banks), p. 179
25b	Lobe of preanal appendage linear, rectangular (Fig. 83). Intermediate appendage arched dorsad, curved laterad, with acuminate tip (Fig. 86)	<i>P. remotus</i> Banks, p. 181
26a (24b)	Clasper, in lateral aspect (Fig. 76), bifid, with two distal lobes	<i>P. nascotius</i> Ross, p. 180
26b	Clasper not bifid (Fig. 68, 90)	27
27a (26b)	Intermediate appendages, in dorsal aspect (Fig. 68), broad, short, cleft	

- distally *P. iculus* Ross, p. 180
- 27b Intermediate appendages thin, tapered distad to acuminate tips; distal quarter angled laterad (Fig. 92) *P. smithae* Denning, p. 181
- 28a (23b) Preanal appendage, in lateral aspect (Fig. 234, 240), simple, unmodified lobe Group G, p. 234 29
- 28b Preanal appendage variously modified (Fig. 221, 227, 250, 256) 30
- 29a (28a) Intermediate appendage, in lateral aspect (Fig. 234), small, acute-triangular, concealed by preanal appendage. Dorsal lobe of clasper, in ventral aspect (Fig. 235), with spine inserted preapically *P. cinereus* Hagen, p. 234
- 29b Intermediate appendage not especially long, but very thin; curved latero-anterad (Fig. 240, 242). Dorsal lobe of clasper without spine (Fig. 241) *P. sabulosus* Leonard & Leonard, p. 234
- 30a (28b) Aedeagus, in lateral aspect (Fig. 224, 231), with vertical pair of long, linear spines visible; recessed within, but probably eversible .. Group F, p. 230 31
- 30b Aedeagus without such spines, other spines present or not (Fig. 249, 252, 259) 32
- 31a (30a) Intermediate appendage, in lateral aspect (Fig. 227), laterad of segment X, long, blade-like, curved postero-ventrad, with preapical spine. Note, also, form of preanal appendage *P. halidus* Milne, p. 230
- 31b Intermediate appendage ventro-mesad of segment X, relatively short, stout, heavily sclerotised, with large disto-lateral tooth (Fig. 221, 222). Note, also, form of preanal appendage *P. denningi* Smith, p. 230
- 32a (30b) Clasper, in ventral aspect (Fig. 245), with two distinct lobes; meso-dorsal lobe with short spines on mesal face (Fig. 248) Group H *P. colei* Ross, p. 238
- 32b Clasper not bilobed (Fig. 251, 258) 33
- 33a (32b) Intermediate appendage, in lateral aspect (Fig. 250), short, blade-like, acuminate Group I *P. picicornis* Stephens, p. 240
- 33b Intermediate appendage long, slender, markedly sclerotised, spine-like (Fig. 256) Group J *P. variegatus* Banks, p. 242
- 34a (1a) Each lateral lobe of sternum VIII, in lateral aspect (Fig. 101, 109, 171, 177), with postero-ventral angle produced posterad as narrow, slightly tapered process 35
- 34b Sternum VIII lateral lobes without such processes (Fig. 66, 115, 131, 158, 254) 38
- 35a (34a) Process of sternum VIII lateral lobes, in ventral aspect, directed postero-mesad (Fig. 102, 110); narrow, of more or less uniform width 36
- 35b Process directed posterad, possibly slightly mesad (Fig. 172, 177); triangular, wide 37
- 36a (35a) Disto-mesal face of sternum VIII lateral lobe process with distinct, broad, acuminate tooth (Fig. 110) *P. weedi* Blickle & Morse, p. 190
- 36b Process without such tooth, rounded, distally featureless (Fig. 102) *P. clinei* (Milne), p. 190
- 37a (35b) Segment X, in lateral aspect (Fig. 171), with broad, rounded process on

	postero-lateral edge, which overlaps segment XI slightly	
		<i>P. aureolus</i> (Banks), p. 212
37b	Segment X without such process (Fig. 177)	<i>P. crassicornis</i> Walker, p. 212
38a (34b)	Lateral lobes of sternum VIII, in lateral aspect, little longer than wide (Fig. 66, 81, 88, 95, 138, 238)	39
38b.	Lateral lobes noticeably longer than wide (Fig. 74, 115, 131, 145, 151, 158, 165, 198, 205, 211, 225, 232, 254, 260)	44
39a (38a)	Sclerotisation of segment X, in lateral aspect, extended completely to dorsum of segment (Fig. 66, 88)	40
39b	Sclerotisation of segment X not complete to dorsum	41
40a (39a)	Distal end of vulval scale, in ventral aspect (Fig. 89), membranous	
		<i>P. remotus</i> Banks, p. 181
40b	Vulval scale sclerotised to distal end (Fig. 67)	
		<i>P. albipunctus</i> (Banks), p. 179
41a (39b)	Lateral lobe of sternum VIII, in lateral aspect, smoothly rounded at all distal edges (Fig. 81, 238)	42
41b	Lateral lobe with angular extremity (Fig. 95), or with indented edge (Fig. 138)	43
42a (41a)	Roughly circular, internal, sclerotised ring visible, in ventral aspect, between bases of sternum VIII lobes (Fig. 239)	
		<i>P. cinereus</i> Hagen, p. 234
42b	Internal sclerite between bases of sternum VIII lateral lobes transverse, rectangular bar with antero-lateral angles produced slightly anterad (Fig. 82)	
		<i>P. nascotius</i> Ross, p. 180
43a (41b)	Distal extremity of sternum VIII lateral lobe, in lateral aspect (Fig. 95), angular	
		<i>P. smithae</i> Denning, p. 181
43b	Distal extremity of lobe indented, irregular (Fig. 138)	
		<i>P. confusus</i> Hagen, p. 196
44a (38b)	Distal, or disto-ventral margin of sternum VIII lateral lobe, in lateral aspect, rough, irregular (Fig. 74, 115, 145, 225)	45
44b	Distal margin not rough, not irregular, but rounded or angular (Fig. 131, 151)	48
45a (44a)	Segment X, in lateral aspect, sclerotised to dorsum (Fig. 115, 225)	46
45b	Segment X not sclerotised to dorsum (Fig. 74, 145)	47
46a (45a)	Dark, arcuate band between bases of sternum VIII lateral lobes, in ventral aspect (Fig. 116)	
		<i>P. blicklei</i> Ross & Yamamoto, p. 195
46b	Band absent (Fig. 226)	
		<i>P. denningi</i> Smith, p. 238
47a (45b)	Vulval scale of two shades separated by transverse wavy line boundary, in ventral aspect (Fig. 75)	
		<i>P. iculus</i> Ross, p. 180
47b	Shading or line absent (Fig. 146)	
		<i>P. elarus</i> Ross, p. 197
48a (44b)	Segment X sclerotised to dorsum (Fig. 131, 151, 158, 205, 211, 254)	52
48b	Segment X not sclerotised to dorsum (Fig. 165, 198, 232, 260)	49
49a (48b)	Lateral lobe of sternum VIII, in lateral aspect, broadly rounded distally (Fig. 232, 260)	50
49b	Lateral lobe evenly tapered distad, to acuminate or angular tip (Fig. 165, 198)	51
50a (49a)	Vulval scale, in lateral aspect (Fig. 232), with tip expanded, curved	

- dorso-anterad *P. halidus* Milne, p. 230
- 50b Vulval scale with tip abruptly narrowed from main body, directed slightly postero-dorsad (Fig. 260) *P. variegatus* Banks, p. 242
- 51a (49b) Segment X, in lateral aspect (Fig. 165), with antero-ventral angle produced antero-ventrad, adjacent to base of sternum VIII lateral lobe *P. pentus* Ross, p. 198
- 51b Segment X ventral angle not produced; distinctly removed from base of sternum VIII lobe (Fig. 198) *P. flavus* (Banks), p. 216
- 52a (48a) Segment XI with one or more dark lines on or across lateral wall (Fig. 131, 158, 205, 254) 53
- 52b Segment XI without such lines (Fig. 151, 211) 56
- 53a (52a) Antero-ventral angle of segment X, in lateral aspect, adjacent to sternum VIII lateral lobe (Fig. 131, 158) 54
- 53b Antero-ventral angle of segment X and lateral lobe of sternum VIII distinctly separated (Fig. 205, 254) 55
- 54a (53a) Internal sclerite, in ventral aspect (Fig. 132), bipartite, each half elongate *P. centralis* Banks, p. 196
- 54b Internal sclerite simple ring, with aperture eccentric (Fig. 159) *P. neiswanderi* Ross, p. 197
- 55a (53b) Lateral lobe of sternum VIII, in lateral aspect (Fig. 254), long, tapered to narrow distal quarter *P. picicornis* Stephens, p. 240
- 55b Lateral lobe short, without narrow tip (Fig. 205) *P. glacialis* Ross, p. 219
- 56a (52b) Lateral lobe of sternum VIII, in lateral aspect (Fig. 211), with acuminate tip *P. interruptus* (Banks), p. 219
- 56b Lateral lobe with broadly rounded tip (Fig. 151) *P. maculatus* Banks, p. 197

SPECIES GROUP A

This group is characterised by ventro-mesal face of male preanal appendage, in lateral aspect, with sclerotised process. This process is directed posterad, or postero-ventrad. It is sinuate or linear, but, in most species, is usually hooked ventrad at distal extremity. Other features are held in common by most species, but for any given feature there will be at least one species which does not exhibit it.

Polycentropus albipunctus (Banks)

Map 14; Fig. 61–67

Plectrocnemia albipuncta Banks, 1930a:131; Betten, 1934:215.

Polycentropus albipunctus; Milne, 1936:85, 88; Ross, 1938a:13; Ross, 1944:293.

Description.— Fore-wing length of male 5.97 mm; pale chocolate-brown, slightly darker along anal edge; pterostigma prominent; no patterning; female slightly irrorate. Hind-wing palely tinted grey-brown. Antennae uniform pale brown; female with basal half of annuli darker. Vertex of head reddish brown. Spurs pale brown; mesal subapical spur of hind-leg with distinct bend two-thirds of length from base. Thorax reddish brown, to straw-brown laterally; female dark reddish brown, to pale straw laterally. Legs pale straw.

Genitalia. Male. (Fig. 61–65). (Specimen from St Hippolyte, Québec). Males recognised by clasper, in lateral aspect (Fig. 61), roughly polygonal; by ventro-mesal process of preanal appendage sinuate; by postero-dorsal edge of preanal appendage produced posterad as blade-like triangular process with distal spine; by dorso-mesal face of clasper with spur

(Fig. 61, 63); and by intermediate appendage with tip recessed to house distal spine (Fig. 62).

Genitalia. Female. (Fig. 66–67). (Specimen from St Hippolyte, Québec). Females recognised by lateral lobe of sternum VIII, in lateral aspect (Fig. 66), quadrate, almost as wide as long; by the same lobe, in ventral aspect (Fig. 67), more or less ovate; and by segment X sclerotised right to dorsum (Fig. 66).

Biology.— Little known, but from the few Canadian records available, it seems that larvae of this species prefer lakes, and the widenings of rivers which appear as lakes. No distinction seems to be made between the aspen parkland sloughs of the west, the acid waters of the boreal forest, or the waters of the lowland hardwood forests of the Maritime Provinces. Canadian flight season dates range from June 27 to August 22.

Distribution.— Scattered records from Cape Breton Island to central Alberta (map 14), north almost to treeline on eastern Hudson's Bay, and south to Minnesota and Massachusetts.

Polycentropus iculus Ross

Map 15; Fig. 68–75

Polycentropus iculus Ross, 1941:74; Ross, 1944:293.

Description.— Fore-wing length of male 6.71 mm; light golden brown; female deeper copper-brown, markedly irrorate. Hind-wing slightly paler in male, slightly tinted distally in female. Vertex of head brown. Antennae pale yellowish brown. Spurs yellow; lateral spur of mid-leg pairs, and hind-leg apical pair notably shorter than mesal companion. Thorax brown, to cream laterally. Legs pale brownish yellow to straw. Overall, the female is a darker red-brown, except thorax is cream laterally as in male.

Genitalia. Male. (Fig. 68–73). (Specimen from Two Ck, Hwy 43, Alberta). Males recognised by clasper, in lateral aspect (Fig. 68), with irregular, linear dorsal edge, with spur of dorso-mesal face located posterad of mid-point; by ventro-mesal process of preanal appendage horizontal, with distal third curved ventrad; by postero-dorsal edge of preanal appendage with small, dentate process delimited by sharp declivity; and by intermediate appendages, in dorsal aspect (Fig. 71), directed postero-laterad, distally bifid, with rounded lateral lobe armed with a short spine.

Genitalia. Female. (Fig. 74–75). (Specimen from Cold Ck, Hwy 16, Nojack, Alberta). Females distinguished by lateral lobe of sternum VIII, in lateral aspect (Fig. 74), roughly ovate, with distal extremity slightly angular, indented; and by segment X not sclerotised right to dorsum.

Biology.— Most of the few records available indicate that larvae of this species may prefer flowing waters, though standing water is indicated by one record. The only locality familiar to me, in Alberta, is a slow, winding, deep, Beaver-haunted forest creek which probably drains muskeg if the colour of the water is any indication. Flight season dates for Canada are June 10 to August 24.

Distribution.— With the present exception of Massachusetts in the United States, this species has only been recorded from Canada (map 15). In Canada the records are almost exclusively from western and southern Québec (extending well up the eastern coast of Hudson's Bay, with one from New Brunswick, and two from Alberta).

Polycentropus nascotius Ross

Map 16; Fig. 76–82

Polycentropus nascotius Ross, 1941:73; Ross, 1944:68.

Description.— Fore-wing length of male 4.91 mm; yellow-brown, no pattern. Hind-wing palely tinted golden brown. Antennae rich orange-brown. Vertex of head deep red-brown. Spurs pale brown; lateral spur of each mid-leg pair, and of hind-leg apical pair notably shorter than mesal companion. Thorax red-brown, to greyish brown laterally. Legs bright orange-brown.

Genitalia. Male. (Fig. 76–80). (Specimen from Ile Ste Hélène, St Lawrence R., Montréal, Québec). Males distinguished by clasper, in lateral aspect (Fig. 76), with narrow base, bilobed distally; by ventro-mesal process of preanal appendage arched dorsad, with distal quarter hooked more sharply ventrad; by postero-dorsal edge of preanal appendage without distal extension; and by intermediate appendage, in dorsal aspect (Fig. 78), curved postero-laterad, tipped distally by small spine, not distally bifid.

Genitalia. Female. (Fig. 81–82). (Specimen from Riverhead, Long Island, N.Y., USA). Females recognised by lateral lobe of sternum VIII, in lateral aspect (Fig. 81), with dorso-distal edge with long, shallow incision, the lobe almost as wide as long; and by segment X not sclerotised to dorsum.

Biology.— Little known. The few Canadian records suggest that it is a species of both standing and flowing waters. Canadian flight season dates range from June 4 to August 25, with predominance in August.

Distribution.— From Kansas and Oklahoma east and northeast to South Carolina and Nova Scotia respectively (map 16). In Canada it is known from eastern Ontario, southern Québec, southern New Brunswick, and Nova Scotia.

Polycentropus remotus Banks

Map 17; Fig. 83–89

Polycentropus remotus Banks, 1911:359; Milne, 1936:85, 88; Ross, 1944:67.

Plectrocnemia remota; Betten, 1934:220.

Description.— Fore-wing length of male 6.55 mm; rich golden brown; bright grey-brown in female. Hind-wing pale golden brown. Antennae dull grey-brown; yellow-brown in female. Vertex of head dull, deep grey-brown. Spurs brown; yellow-brown in female; lateral spur of each mid-leg pair notably shorter than mesal companion. Thorax very dull, dark brown, to almost grey laterally. Legs pale grey-brown.

Genitalia. Male. (Fig. 83–87). (Specimen from Waterton R., Waterton National Park gate, Alberta). Males distinguished by clasper, in lateral aspect (Fig. 83), massive, with spur on dorso-mesal face, and sinuate flange across mesal face; by ventro-mesal process of preanal appendage rectangular, with minute ventral tooth at distal end; and by intermediate appendages, in dorsal aspect (Fig. 86), directed postero-laterad, slender, long, with distal tooth directed laterad.

Genitalia. Female. (Fig. 88–89). (Specimen from Crow Ck, Hwy 63, S of Ft McMurray, Alberta). Females distinguished by very large, parallelogram-like lateral lobe of sternum VIII, in lateral aspect (Fig. 88); by vulval scale, in ventral aspect (Fig. 89), membranous distally; and by segment X, in lateral aspect, sclerotised right to dorsum (though only just, at one point).

Biology.— Available records, insofar as they may be useful, indicate that this species exercises a very wide ecological tolerance, being recorded from reasonably fast foothills streams; from slow, deep, peaty northern creeks; from larger, rocky rivers; and from a variety of lakes and prairie sloughs. Flight season records from Canada range from June 18 to August 30, with predominance in July.

Distribution.— Transcontinental, from Alaska and Washington State, to Kentucky and Newfoundland (map 17). In Canada it is presently unknown from north of the sixtyeth parallel, but is fairly general southward, though not known from the Maritime Provinces.

Polycentropus smithae Denning

Map 18; Fig. 90–96

Polycentropus smithae Denning, 1949:39.

Description.— Fore-wing length of male 7.41 mm; pale golden brown. Hind-wing very palely tinted golden. Antennae yellow. Vertex of head deep yellow-brown. Spurs brownish yellow; lateral spur of each mid-leg pair notably shorter than mesal companion; in the female this is also so for the hind-leg apical pair. Thorax dark brown, to grey-brown laterally. Legs pale brownish yellow to straw.

Genitalia. Male. (Fig. 90–94). (Specimen from Two Ck, Hwy 43, Alberta). Males distinguished by clasper, in lateral aspect (Fig. 90), elliptical, with spur on dorsal edge of mesal face; by ventro-mesal process appendage with distal third angled sharply ventrad; ventral extremity of preanal appendage with distinct spur; by dorso-distal edge of preanal appendage without distal process; and by intermediate appendage, in lateral aspect (Fig. 90), corkscrew-like, and in dorsal aspect (Fig. 92), with distal quarter angled sharply laterad, with small distal spine.

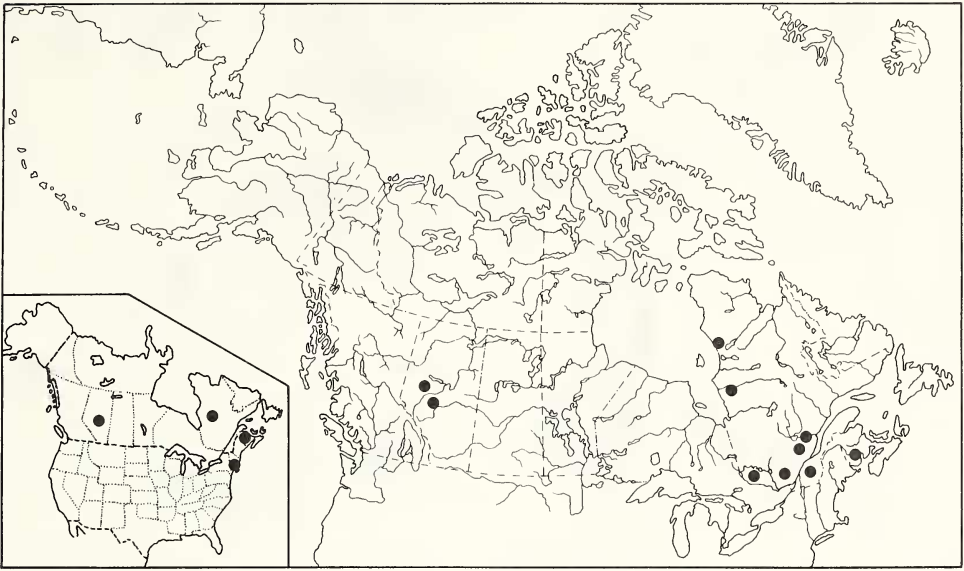
Genitalia. Female. (Fig. 95–96). (Specimen from Battle R., Hwy 14, W of Wainwright, Alberta). Females recognised by lateral lobe of sternum VIII, in lateral aspect (Fig. 95), with dorsal edge linear, ventral edge distinctly curved, and tip bluntly acuminate (Fig. 95–96); and by segment X not sclerotised to dorsum.

Biology.— The few available informative records indicate that this species lives, in the larval stage, in lakes, and a variety of smaller streams, either silt or gravel bottomed. Canadian flight season records range from June 16 to August 15, with predominance in July.

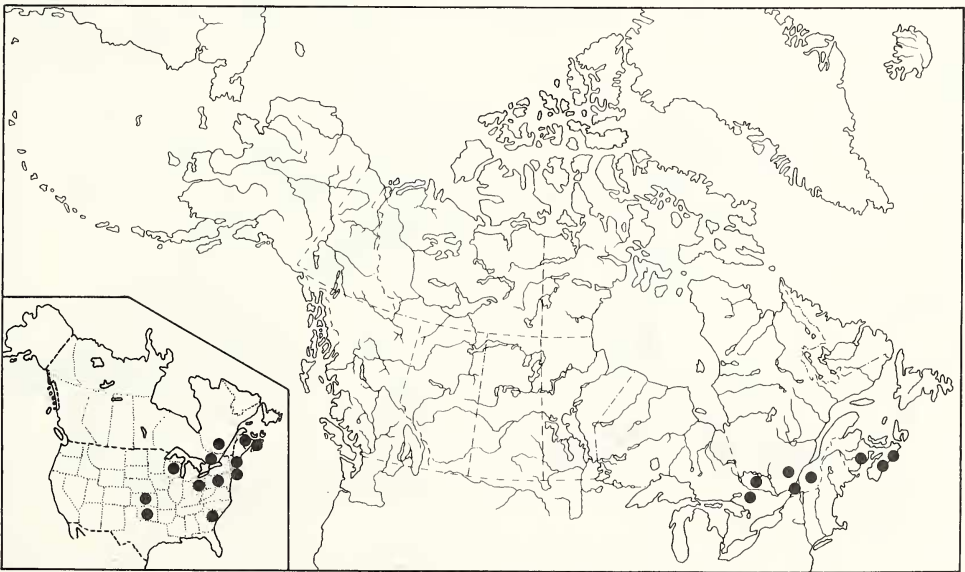
Distribution.— Transcontinental from Yukon and Vancouver Island to New Hampshire and extreme eastern Québec, with a large gap in Saskatchewan, Manitoba, and northern Ontario (map 18).



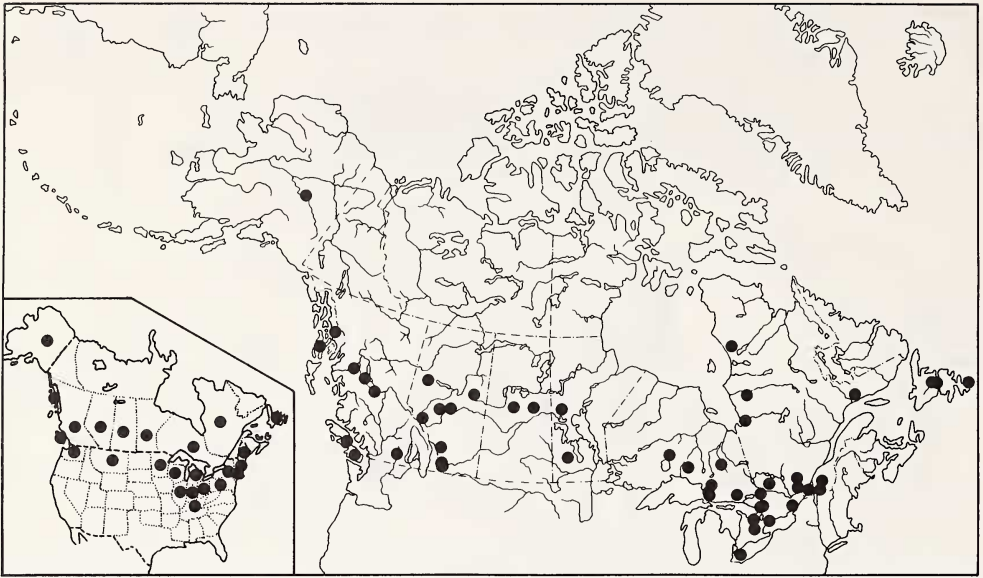
Map 14. Collection localities for *Polycentropus albipunctus* (Banks) in Canada, with known distribution in North America by state or province.



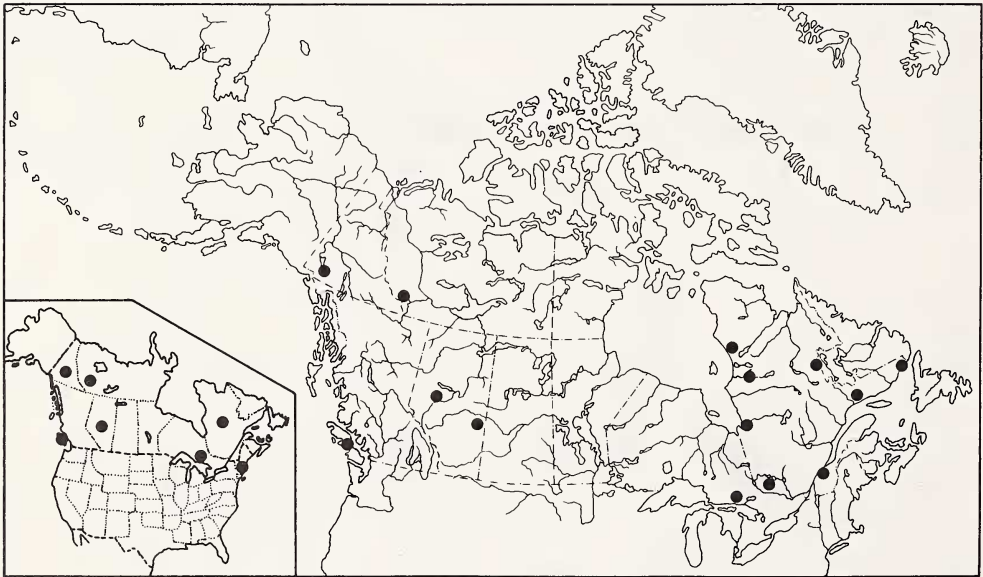
Map 15. Collection localities for *Polycentropus iculus* Ross in Canada, with known distribution in North America by state or province.



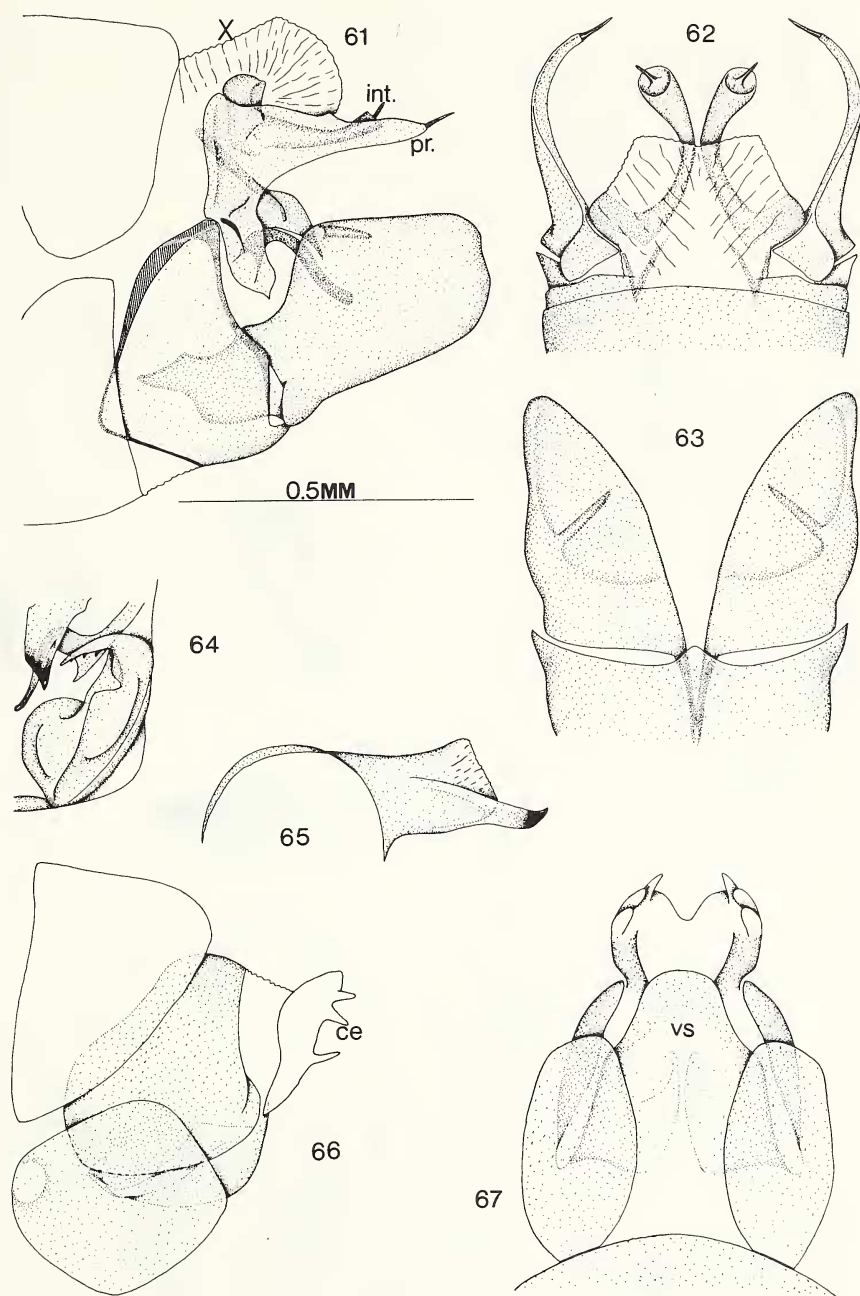
Map 16. Collection localities for *Polycentropus nascotius* Ross in Canada, with known distribution in North America by state or province.



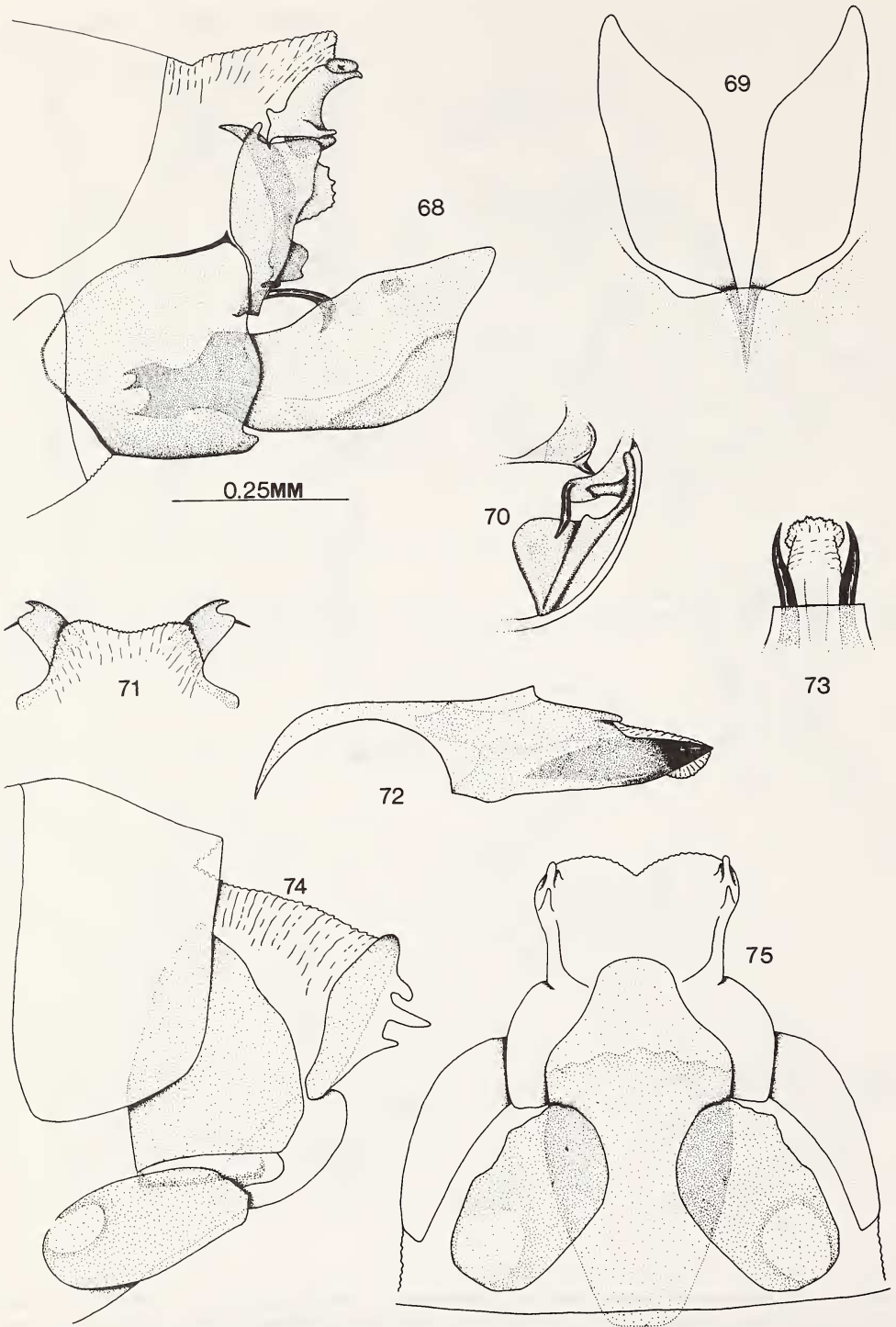
Map 17. Collection localities for *Polycentropus remotus* Banks in Canada and Alaska, with known distribution in North America by state or province.



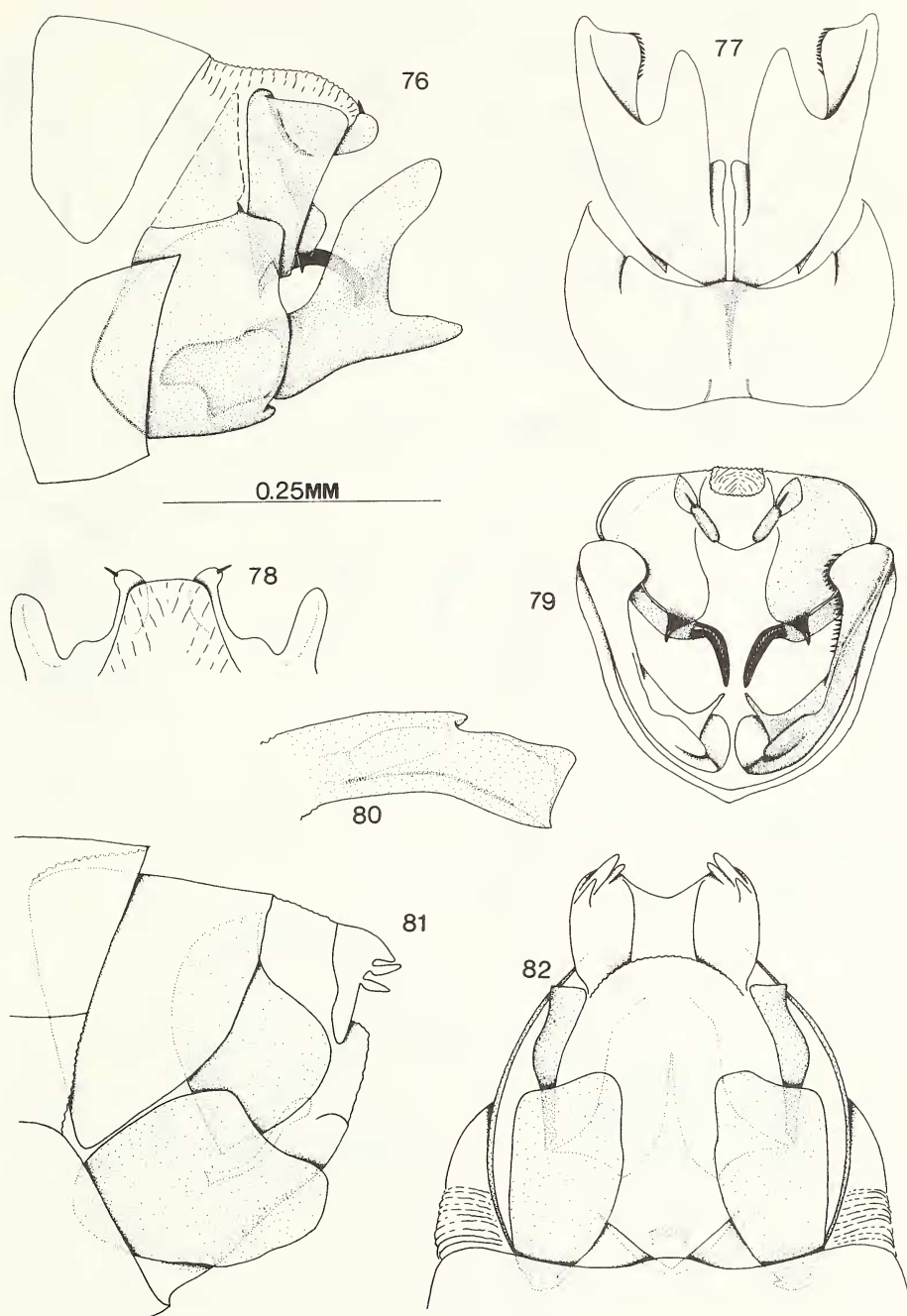
Map 18. Collection localities for *Polycentropus smithae* Denning in Canada, with known distribution in North America by state or province.



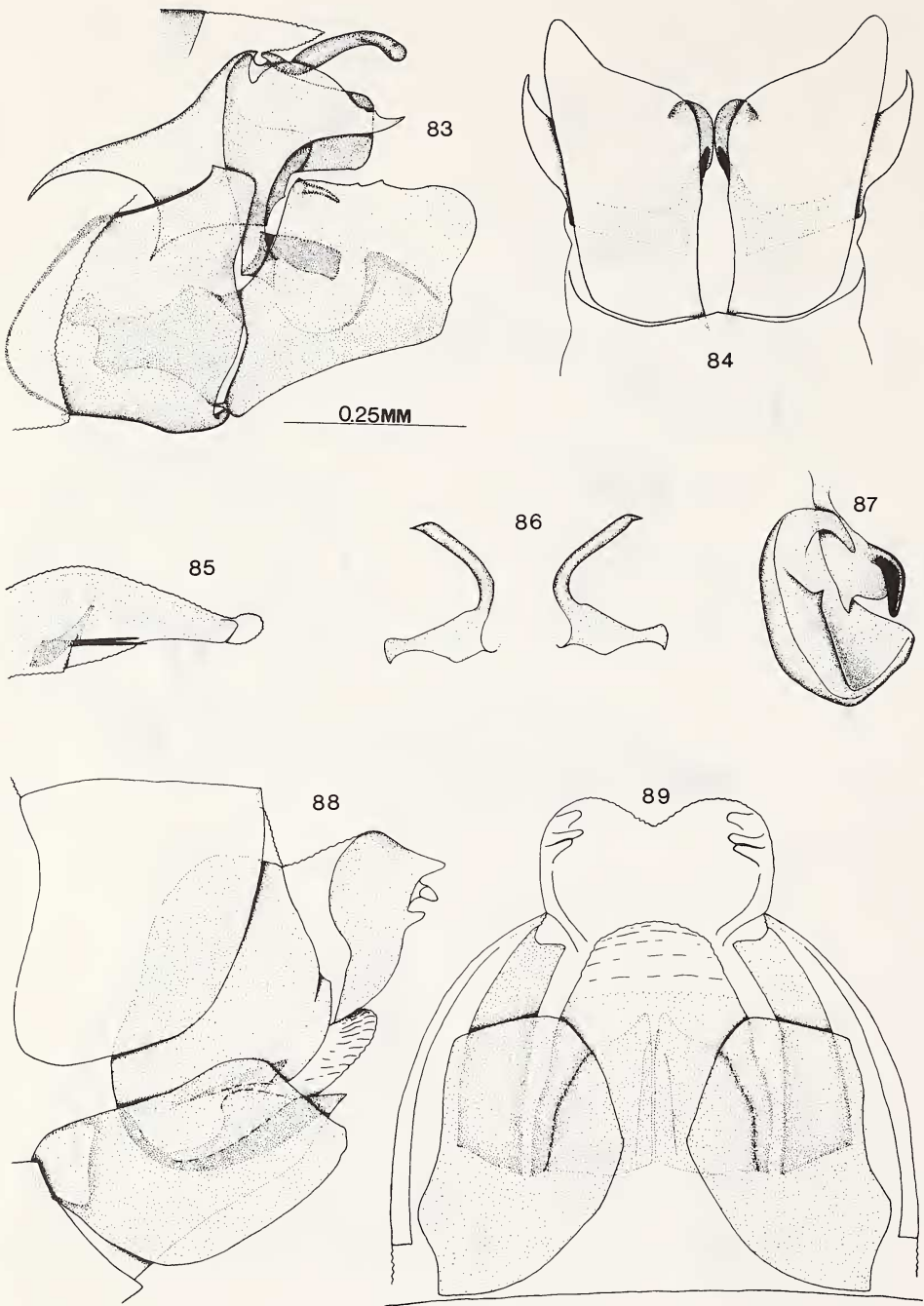
Figs. 61-67, *Polycentropus albipunctus* (Banks): 61, genital capsule of male, lateral aspect; 62, genital capsule of male, dorsal aspect; 63, genital capsule of male, ventral aspect; 64, right inferior appendage (clasper) of male, posterior aspect; 65, aedeagus of male, lateral aspect; 66, genital segments of female, lateral aspect; 67, genital segments of female, ventral aspect. Legend: ce. – cercus; int. – intermediate appendage; pr. – preanal appendage; vs. – vulval scale; X – tergum X.



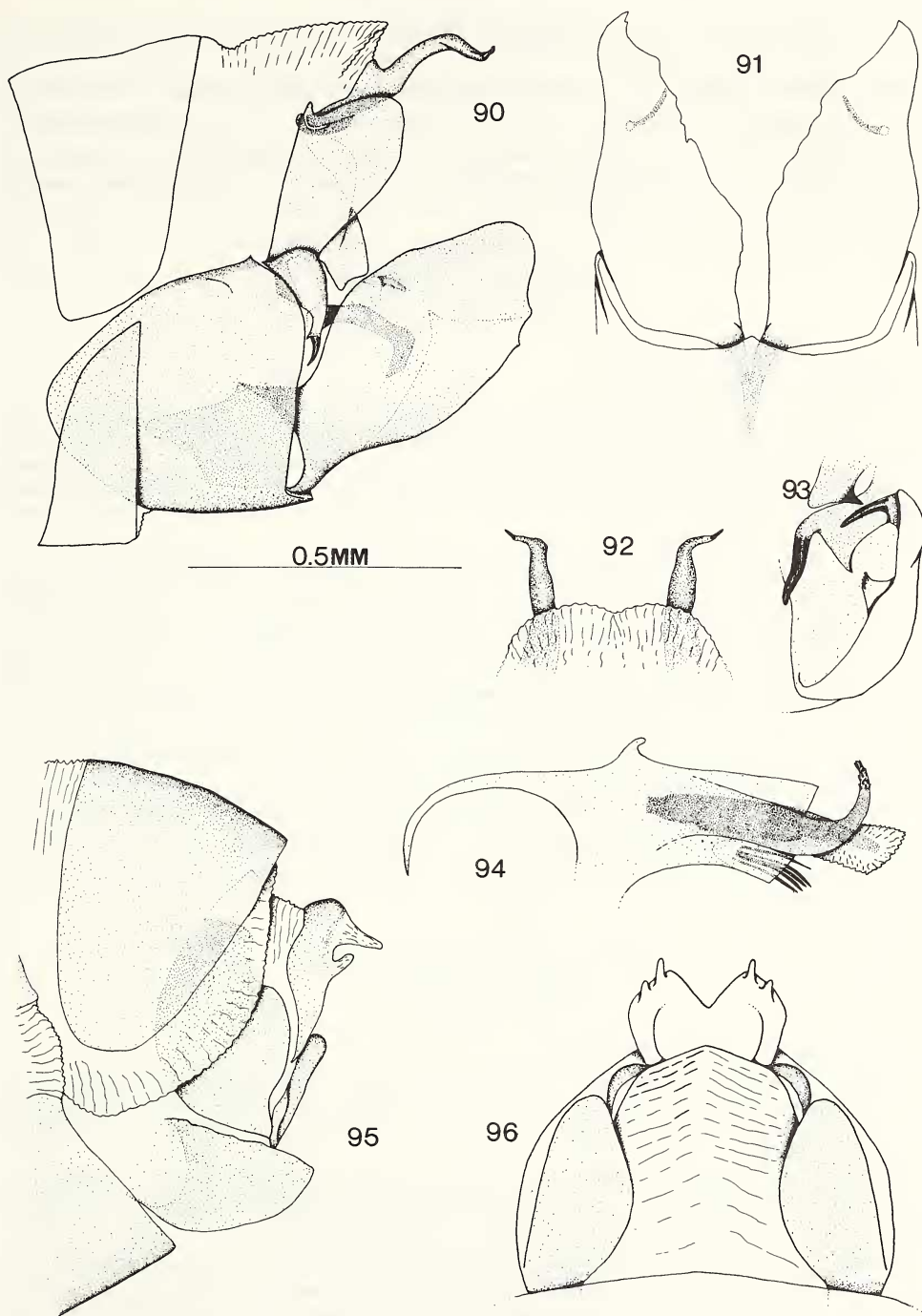
Figs. 68-75, *Polycentropus iculus* Ross: 68, genital capsule of male, lateral aspect; 69, genital capsule of male, ventral aspect; 70, right inferior appendage (clasper) of male, posterior aspect; 71, segment X and intermediate appendages of male, dorsal aspect; 72, aedeagus of male, lateral aspect; 73, aedeagus of male, dorsal aspect of tip; 74, genital segments of female, lateral aspect; 75, genital segments of female, ventral aspect.



Figs. 76-82, *Polycentropus nascotius* Ross: 76, genital capsule of male, lateral aspect; 77, genital capsule of male, ventral aspect; 78, segment X and intermediate appendages of male, dorsal aspect; 79, genital capsule of male, posterior aspect; 80, aedeagus of male, lateral aspect; 81, genital segments of female, lateral aspect; 82, genital segments of female, ventral aspect.



Figs. 83-89, *Polycentropus remotus* Banks: 83, genital capsule of male, lateral aspect; 84, genital capsule of male, ventral aspect; 85, aedeagus of male, lateral aspect; 86, intermediate appendages (clasper) of male, dorsal aspect; 87, left inferior appendage of male, posterior aspect; 88, genital segments of female, lateral aspect; 89, genital segments of female, ventral aspect.



Figs. 90-96, *Polycentropus smithae* Denning: 90, genital capsule of male, lateral aspect; 91, genital capsule of male, ventral aspect; 92, segment X and intermediate appendages of male, dorsal aspect; 93, right inferior appendage (clasper) of male, posterior aspect; 94, aedeagus of male, lateral aspect; 95, genital segments of female, lateral aspect; 96, genital segments of female, ventral aspect.

SPECIES GROUP B

Males of this group are characterised by postero-ventral edge of segment IX produced posterad as distally rounded, tubular process, which may be long or short; by relatively small, short, shallowly bifid, 'lumpy' claspers; and by the distally bifid intermediate appendages. In the females the lateral lobes of sternum VIII possess narrow, postero-mesally directed processes with origin at the disto-mesal corner.

Polycentropus clinei (Milne)

Map 19; Fig. 97–102

Plectrocnemia clinei Milne, 1936:87, 88.*Polycentropus clinei*; Ross, 1944:293.

Description.— Fore-wing length of male 8.71 mm; purple-brown; heavily and finely irrorate distally; heavily and coarsely irrorate basally and along costal edge. Hind-wing palely tinted. Antennae deep purple-brown, with distal half of each annulus paler. Vertex of head dark brown; most setae silver, with lateral ones black. Silver setae continued along centre line of thoracic dorsum. Preapical spur of fore-tibia half as long as apical spurs. Lateral spur of each mid-leg pair notably shorter than mesal companion. Thorax dark reddish brown, to dull red and yellow-brown laterally. Legs red-brown to dull straw.

Genitalia. Male. (Fig. 97–100). (Specimen from Mt Uniacke, Nova Scotia). Males recognised by postero-ventral process of segment IX quite as long as clasper, in lateral aspect (Fig. 97); by distal half of aedeagus, in lateral aspect (Fig. 100), with three distinct spines visible; by ventral process of preanal appendage minutely setate; and by lateral branch of intermediate appendage, in lateral aspect (Fig. 97), only gently bowed ventrad, the whole directed more or less posterad.

Genitalia. Female. (Fig. 101–102). (Specimen from Kouchibouguac National Park, New Brunswick). Females recognised by postero-mesal process of lateral lobe of sternum VIII rounded distally, without disto-mesal tooth (Fig. 102); by cerci and dorsal and ventral lobes of segment XI directed postero-mesad (Fig. 102); and by segment X not sclerotised right to dorsum, with ventral edge partially concealed by dorsal projection of sternum VIII lateral lobe (Fig. 101).

Biology.— The very few records indicate that larvae of this species may be confined to lakes and weedy ponds. Canadian flight dates range from June 29 to July 24.

Distribution.— Primarily the eastern seaboard of North America, from North Carolina to Newfoundland, but with records from southern Ontario and Minnesota (map 19). In Canada the only records are one from southern Ontario (Muskoka district), and several from the Atlantic Provinces.

Polycentropus weedi Bickel & Morse

Map 20; Fig. 103–110

Polycentropus weedi Bickel & Morse, 1955:95.

Description.— Fore-wing length of male 7.02 mm; light golden brown, no evident patterning. Hind-wing faintly tinted golden brown, especially on distal quarter. Antennae brown. Vertex of head orange-brown. Spurs light brown; lateral spur of all mid- and hind-leg pairs notably shorter than mesal companion. Thorax dark brown, to greyish brown laterally. Legs dull brown.

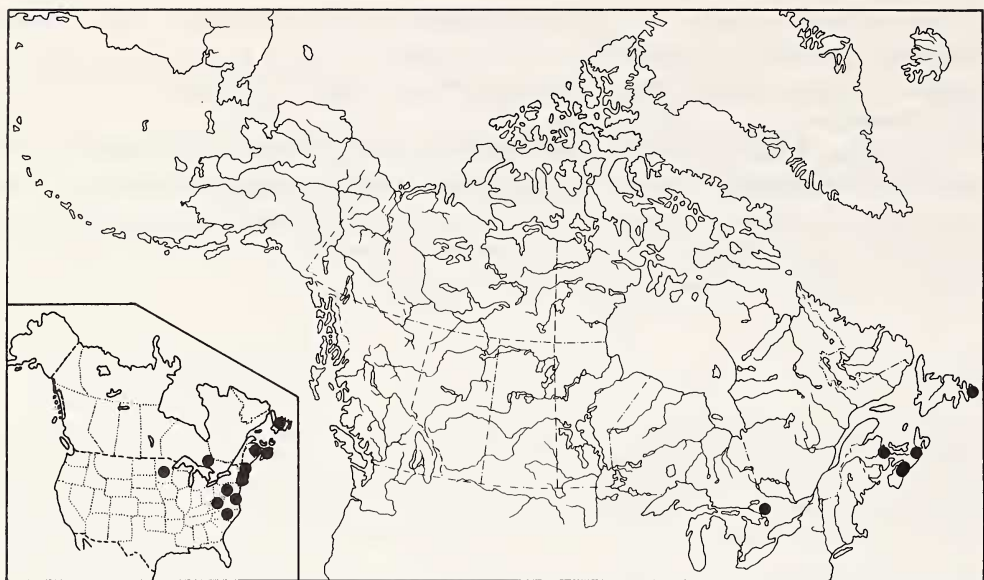
Genitalia. Male. (Fig. 103–108). (Specimen from McLeod R., Hwy 47 to Robb, Alberta). Males distinguished by postero-ventral process of segment IX short, barely a quarter the length of clasper (Fig. 103); by ventral process of preanal appendage, in lateral aspect (Fig. 103), with posterior edge serrate; by aedeagus without spines (Fig. 107); and by lateral branch of intermediate appendage, in lateral aspect (Fig. 103), curved sharply dorsad.

Genitalia. Female. (Fig. 109–110). (Specimen from St John's, Newfoundland). The only specimen available to me was damaged and had dried out. Hence the two drawings presented here are the only ones I could make with any assurance of accuracy. However, this suffices to permit discrimination of *P. weedi* females from those of *P. clinei* (above), and for use in the key. Females of *P. weedi* are distinguished by postero-mesal process of lateral lobe of sternum VIII, in ventral aspect (Fig. 110), with disto-mesal tooth on each.

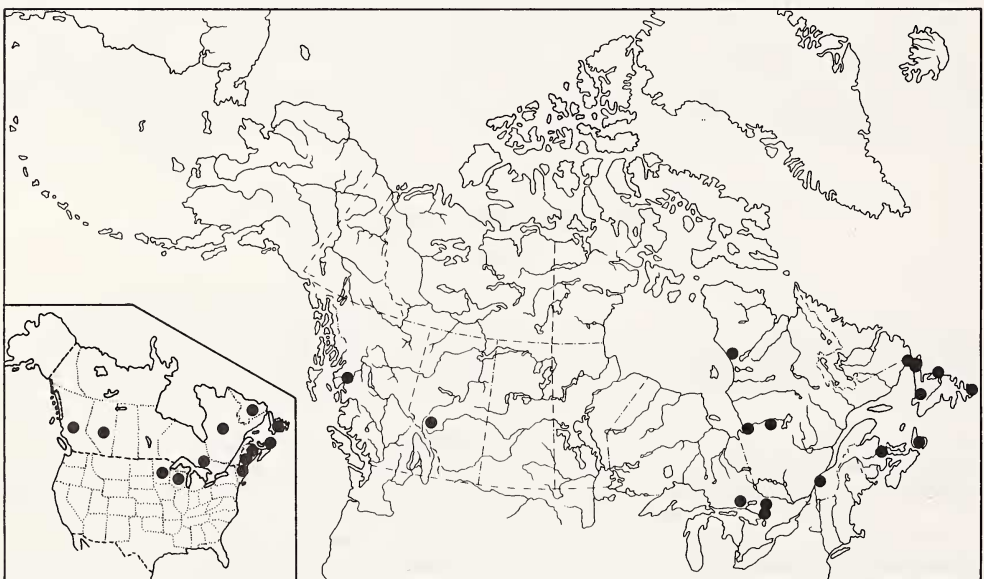
Biology.— Little known. Flight season dates available from Canada range from June 21 to August 17, with predominance in July. Most records do not indicate what type of water body

was adjacent to the collecting site. The very few which do, indicate that larvae of this species inhabit both flowing and standing waters. The McLeod R. in Alberta, at point of collecting, is perhaps 15 m. wide, with boulder and fine sediment bottom, and is located in the foothills of the Rocky Mountains.

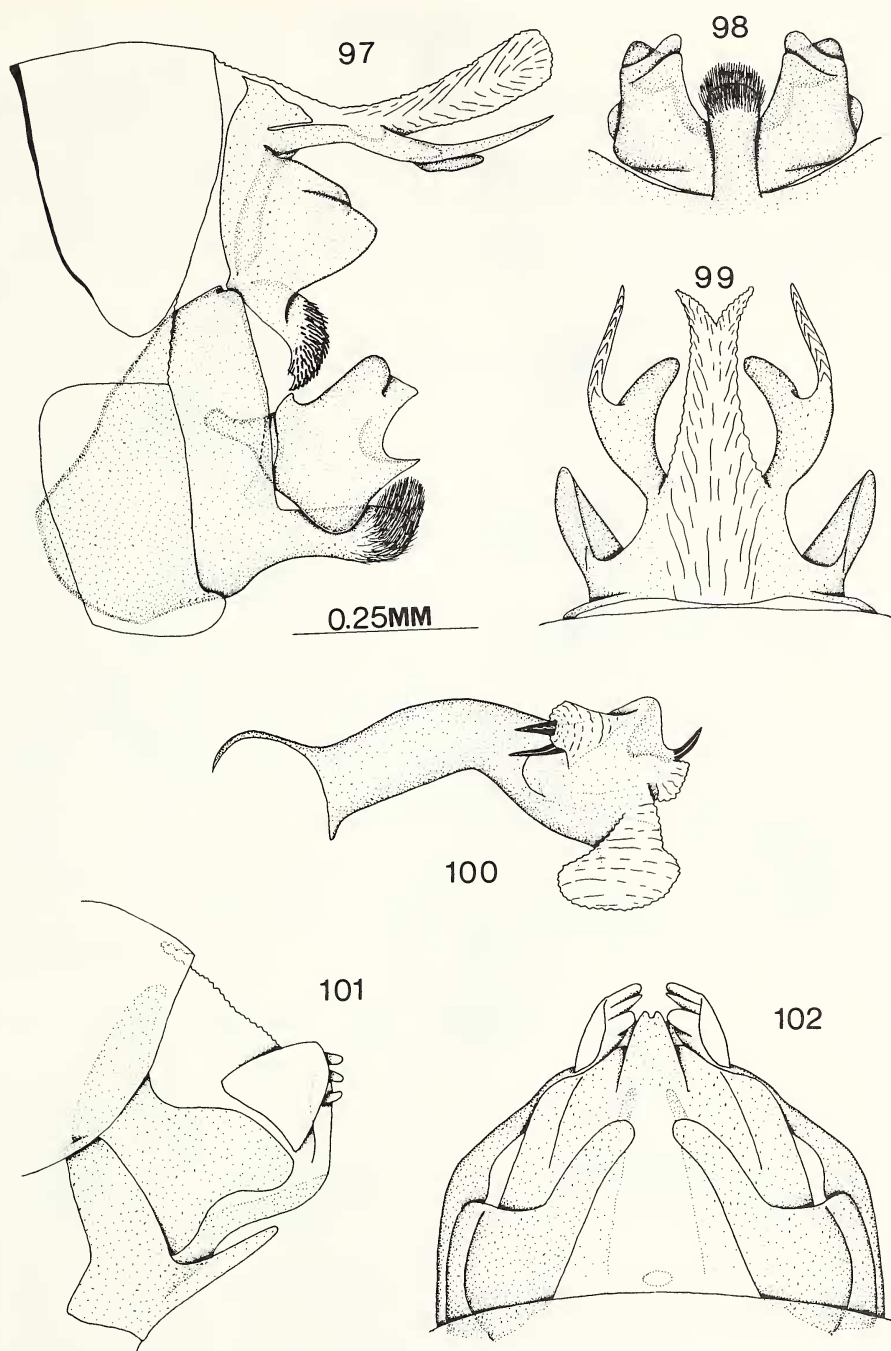
Distribution.— Scattered but fairly general from eastern Ontario to Newfoundland, with records from Minnesota to Maine in the United States (map 20). Further west there is one record each from Alberta and British Columbia. I had the opportunity to examine the Terrace, B.C. specimen side by side with a male from Baddeck, Cape Breton Island. They were quite identical to the eye in all respects.



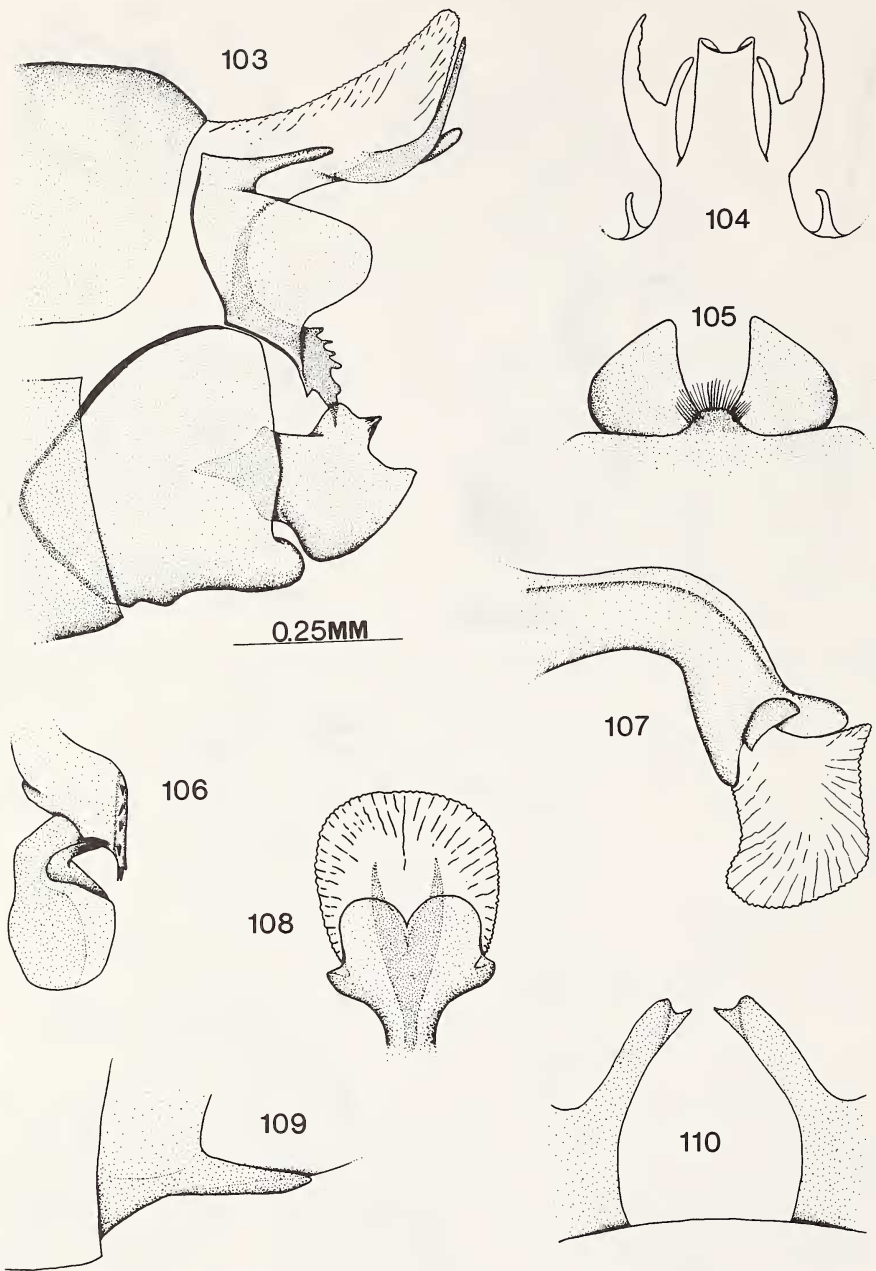
Map 19. Collection localities for *Polycentropus clinei* Milne in Canada, with known distribution in North America by state or province.



Map 20. Collection localities for *Polycentropus weedi* Bickle and Morse in Canada, with known distribution in North America by state or province.



Figs. 97-102, *Polycentropus clinei* Milne: 97, genital capsule of male, lateral aspect; 98, genital capsule of male, ventral aspect; 99, genital capsule of male, dorsal aspect; 100, aedeagus of male, lateral aspect; 101, genital segments of female, lateral aspect; 102, genital segments of female, ventral aspect.



Figs. 103-110, *Polycentropus weedi* Blicke & Morse: 103, genital capsule of male, lateral aspect; 104, genital capsule of male, dorsal aspect; 105, genital capsule of male, ventral aspect; 106, left inferior appendage (clasper) of male, posterior aspect; 107, aedeagus of male, lateral aspect; 108, aedeagus of male, dorsal aspect of tip; 109, left half of sternum VIII of female, lateral aspect; 110, both halves of sternum VIII of female, ventral aspect.

SPECIES GROUP C

Males of this group are characterised by preanal appendage, in lateral aspect, with dorsal extremity produced as a long, variably narrow blade in most species curved postero-ventrad, but recurved in some species; by intermediate appendage as a simple, slightly curved, short process ventrad of segment X; and by clasper, in lateral aspect, deeply bilobed – the ventral lobe usually tapered, usually acuminate, and the dorsal lobe usually with tip expanded as ventral tooth (in one species, this tooth may be absent, or may appear to be absent at first glance).

Polycentropus blicklei Ross & Yamamoto

Map 21; Fig. 111–116

Polycentropus blicklei Ross & Yamamoto, 1965:243.

Description.— Fore-wing length of male 6.20 mm; pale chocolate-brown; faintly irrorate, most notably on distal half. Hind-wing palely tinted. Female darker overall. Antennae straw; chocolate-brown in female. Vertex of head red-brown except paler about posterior end of median suture; female darker. Spurs straw; preapical spur of fore-tibia about half length of others; in the female the mid- and hind-leg lateral spurs all notably shorter than mesal companions. Thorax mottled red-brown to pale red-brown. Legs reddish cream.

Genitalia. Male. (Fig. 111–114). (Specimen from Kents Pond, Newfoundland). Males recognised by clasper ventral lobe evenly tapered distad to almost acuminate tip, slightly curved, in lateral aspect (Fig. 111); by dorsal lobe of clasper with ventral process directly ventrad of tip, triangular (Fig. 111), the lobe as a whole not directly visible in ventral aspect (Fig. 113); by preanal appendage postero-ventral edge sinuate, not produced posterad, in lateral aspect (Fig. 111); and by dorsal process of preanal appendage with distal three-quarters linear, and distal half widened prior to tip.

Genitalia. Female. (Fig. 115–116). (Specimen from Ganaraska R., Garden Hill, Durham Co., Ontario). Females distinguished by segment X, in lateral aspect (Fig. 115), sclerotised right to dorsum, but far removed from lateral lobe of sternum VIII; by lateral lobe of sternum VIII, in lateral aspect, widened at mid-point, with irregular distal edges; and by arcuate dark band between bases of sternum VIII lateral lobes, in ventral aspect (Fig. 116).

Biology.— Again, a species of standing and flowing waters – otherwise nothing known. Flight dates from Canada range from May 5 to July 26.

Distribution.— Widespread from Mississippi to Newfoundland (map 21). In Canada the species is known from southern Ontario, southern Québec, and from the Atlantic Provinces, but records are scanty.

Polycentropus carolinensis Banks

Map 22; Fig. 117–121

Polycentropus carolinensis Banks, 1905b:217; Betten, 1934:220; Milne, 1936:88 (as synonym of *P. confusus*); Ross, 1944:66.

Description.— Fore-wing length of male 6.44 mm; uniform light yellowish brown, irrorate posterad of Cula + b. Hind-wing tinted pale grey-brown. Antennae light yellow-brown. Vertex of head chocolate-brown, warts paler. Spurs light brown; lateral spur of each mid-leg pair shorter than mesal companion. Thorax chocolate-brown, to yellow laterally. Legs dull straw.

Genitalia. Male. (Fig. 117–121). (Specimen from St Hippolyte, Québec). Males recognised by ventral lobe of clasper, in lateral aspect (Fig. 117), tapered to relatively acute tip, fairly stout throughout, not curved; by dorsal lobe of clasper short, the stem very short, stout, with ventral process directed ventrad of tip, rounded; preanal appendage posterior edge slightly, broadly produced posterad, in lateral aspect; and by dorsal process of preanal appendage broadly curved in basal half, with distal half virtually linear, widened then abruptly narrowed to long, spinate tip.

Genitalia. Female. Unknown.

Biology.— Virtually nothing known. The only Canadian flight date available to me is July 22, near Montreal.

Distribution.— Very fragmentary (map 22), being, to date, recorded only from Tennessee, North Carolina, New Hampshire, and southern Québec.

Polycentropus centralis Banks

Map 23; Fig. 127–132

Polycentropus centralis Banks, 1914:258; Betten, 1934:221; Milne, 1936:85, 88; Ross, 1944:64.

Description.— Fore-wing length of male 6.50 mm; yellow-brown to brown, irroration strongest distally. Hind-wing palely tinted; faint in female. Antennae pale straw to cream; brown in female. Vertex of head uniformly pale red-brown. Spurs pale brown; fore-tibia preapical spur subequal to apical spurs; lateral spur of mid-leg pairs, and of hind-leg apical pair, notably shorter than mesal companion. Thorax red-brown, to straw and cream laterally. Legs pale red-brown.

Genitalia. Male. (Fig. 127–130). (Specimen from Aspen Bk, Newfoundland). Males distinguished by ventral lobe of clasper, in lateral aspect (Fig. 127), narrow, of almost uniform width, with secondary lobe on mesal face; by dorsal lobe of clasper inserted distad of clasper base, short, with right-triangular ventral lobe along most of ventral edge; by ventral extremity of preanal appendage, in lateral aspect (Fig. 127), with small, rounded, papillate process; by dorsal process of preanal appendage with basal quarter gently curved, and distal three-quarters long, linear, narrow; and by dorsal lobe of clasper, in ventral aspect (Fig. 129), visible laterad of ventral lobe.

Genitalia. Female. (Fig. 131–132). (Specimen from Hutchins Ck, Wolf Lk, Illinois, USA). Females recognised by lateral lobe of sternum VIII, in lateral aspect (Fig. 131), with narrow base widened to main portion of lobe which is of uniform width till distal quarter where it is abruptly narrowed to triangular tip; by segment X sclerotised to dorsum, with ventral extremity adjacent to lateral lobe of sternum VIII; and by internal sclerites, in ventral aspect (Fig. 132), bipartite, each half long, spindle-like.

Biology.— Ross (1944) records larvae of this species from small, clear, rapid streams, with an Illinois flight season ranging from May 25 to October 5. The few Canadian records span the period July 13 to August 16.

Distribution.— From Texas to Minnesota and Newfoundland (map 23). In Canada I have one record from southern Ontario, the remainder from Nova Scotia and Newfoundland.

Polycentropus confusus Hagen

Map 24; Fig. 133–139

Polycentropus confusus Hagen, 1861:293; Milne, 1936:85, 88; Ross, 1944:65.*Plectrocnemia confusus*; Banks, 1907a:47.

Description.— Fore-wing length of male 6.86 mm; pale grey-brown, with distinct pterostigma. Hind-wing palely tinted grey-brown. Antennae uniform yellow-brown. Spurs yellow-brown; mesal spur of mid-leg subapical pair only half as long as lateral companion. Thorax red-brown, to straw laterally. Legs pale straw.

Genitalia. Male. (Fig. 133–137). (Specimen from Nominigüe, Québec). Males distinguished by ventral lobe of clasper, in lateral aspect (Fig. 133), long, stout, well rounded distally, with distinct declivity along lateral face; by dorsal lobe stout, curved slightly posterad at tip, apparently without ventral lobe in lateral aspect (but this is concealed by base of dorsal lobe); by postero-ventral edge of preanal appendage with right-triangular lobe; by dorsal process of preanal appendage with narrow base, then gradually widened to distal quarter where it tapers sharply to acuminate tip; by intermediate appendage, in lateral aspect (Fig. 133), quite large, broad; and by dorsal lobe of clasper, in ventral aspect (Fig. 134), almost entirely visible laterad of ventral lobe.

Genitalia. Female. (Fig. 138–139). (Specimen from Grenville, Québec). Females recognised by segment X, in lateral aspect (Fig. 138), not sclerotised to dorsum, with ventral extremity very close to lateral lobe of sternum VIII; by lateral lobe of sternum VIII, in lateral aspect, with distal edge truncate, irregularly dentate; and by distal edge of sclerite at base of segment XI, in ventral aspect (Fig. 139), with two triangular processes which give the edge the appearance of an inverted W.

Biology.— According to available records this appears to be a species of lakes and smaller rivers and streams. Flight season dates for Canada range from June 6 to September 2, with predominance in June and July.

Distribution.— From the United States mid-west to the Atlantic coast and Newfoundland (map 24). In Canada this species is well recorded from southern Ontario, eastern Hudson's Bay and east to Newfoundland.

Polycentropus elarus Ross.

Map 25; Fig. 140–146

Polycentropus elarus Ross, 1944:65.

Description.— Fore-wing length of male 6.32 mm; pale yellow-brown. Hind-wing hyaline. Antennae yellow-brown, each annulus with pale, narrow band two-thirds distance from base. Vertex of head red-brown. Lateral spur of mid-leg pairs longer than mesal companion. Thorax red-brown, to yellow-brown laterally. Legs straw.

Genitalia. Male. (Fig. 140–144). (Specimen from St Hippolyte, Québec). Males distinguished by ventral lobe of clasper very long, slightly irregular, with tip turned slightly dorsad, in lateral aspect (Fig. 140); by dorsal lobe of clasper short, with very narrow stem terminated in large, rounded tip with triangular ventral lobe; by preanal appendage without postero-ventral process; by dorsal process of preanal appendage recurved, of slightly varied width; by intermediate appendage with base concealed within segment X; and by dorsal lobe of clasper, in ventral aspect (Fig. 141), not visible.

Genitalia. Female. (Fig. 145–146). (Specimen from St Hippolyte, Québec). Females distinguished by lateral lobe of sternum VIII, in lateral aspect (Fig. 145), large, angular, with irregular disto-ventral edge; by segment X not sclerotised to dorsum, with ventral extremity partly concealed by base of sternum VIII lobe; and by internal sclerite, in ventral aspect (Fig. 146), a simple ring flanked postero-laterally by a pair of bifid sclerites.

Biology.— A lake and stream species. Canadian flight dates range from April 28 to September 4.

Distribution.— Scattered, from Tennessee and Kentucky to New Hampshire, Québec and southern Ontario (map 25). In Canada this species is known only from the Great Lakes – St Lawrence drainage.

Polycentropus maculatus Banks

Map 26; Fig. 147–152

Polycentropus maculatus Banks, 1908:65; Betten, 1934:221; Milne, 1936:88 (as synonym for *P. confusus*); Ross, 1944:65.

Description.— Fore-wing length of male 6.45 mm; dull yellow-brown, distal half faintly irrorate. Hind-wing palely tinted. Antennae uniformly yellow-brown; mesal face of pedicel heavily setose. Vertex of head deep yellow-brown, warts paler straw-brown; female with pair of pale spots close to posterior edge, one on either side of median suture. Spurs yellow-brown; preapical spur of fore-tibia notably shorter than apical pair. Thorax deep yellow-brown, to straw laterally. Legs uniform straw.

Genitalia. Male. (Fig. 147–150). (Specimen from Aspen Bk, Newfoundland). Males distinguished by postero-ventral corner of preanal appendage, in lateral aspect (Fig. 147), with acute-triangular process directed posterad; by preanal appendage dorsal process very long, narrow, very gradually tapered throughout to tip which is almost in contact with ventral lobe of clasper; by intermediate appendage massive, broad in lateral aspect; and by dorsal lobe of clasper, in ventral aspect (Fig. 148), just visible mesad of ventral lobe.

Genitalia. Female. (Fig. 151–152). (Specimen from Aspen Bk, Newfoundland). Females recognised by lateral lobe of sternum VIII, in lateral aspect (Fig. 151), much longer than broad, wider distally, distally rounded; by segment X sclerotised to dorsum (just), with ventral extremity very close to lateral lobe of sternum VIII; and by vulval scale with membranous extremity which may be folded back on itself along ventral surface (Fig. 151, 152).

Biology.— Little known, but the indications are that the larvae live in small, gravel rivers and brooks or streams. Flight season dates for Canada range from June 6 to September 11.

Distribution.— From Tennessee and South Carolina to northern Québec and Newfoundland (map 26). With the present exception of one record from the east coast of Hudson's Bay, in Québec, all Canadian records of this species are grouped about the St Lawrence River valley and estuary.

Polycentropus neiswanderi Ross

Map 27; Fig. 153–159

Polycentropus neiswanderi Ross, 1947:135.

Description.— Fore-wing length of male 5.54 mm; light red-brown, no pattern evident. Hind-wing R3+3 unforked in male. Antennae red-brown. Vertex of head deep red-brown. Spurs dull red-brown; lateral spur of both mid-leg pairs, and of hind-leg apical pair, notably shorter than mesal companion. Thorax deep red-brown. Legs dull red-brown.

Genitalia. Male. (Fig. 153–157). (Specimen from Shawnee Forest, Ohio, USA – holotype). Males recognised by ventral lobe of clasper, in lateral aspect (Fig. 153), large, wide, slightly expanded, broadly rounded distally; by dorsal lobe of clasper without ventral lobe; by body of preanal appendage pinched in at mid-point, with small dorsal lobe ventrad of base of dorsal process; by dorsal process of preanal appendage curved throughout, slender, very gradually tapered, with distal spine; by segment X, in dorsal aspect (Fig. 154), distally bilobed; and by dorsal lobe of clasper, in ventral aspect (Fig. 155), visible laterad of ventral lobe.

Genitalia. Female. (Fig. 158–159). (Specimen from Shawnee Forest, Ohio, USA – paratype). Females distinguished by lateral lobe of sternum VIII, in lateral aspect (Fig. 158), expanded at mid-point, then tapered distad to distal quarter of uniform width to rounded tip; by segment X sclerotised to dorsum on wide front, with ventral extremity adjacent to lateral lobe of sternum VIII; by sclerotised vulval scale with well defined basal margin in shape of bell curve; and by internal sclerite a simple ring with eccentric aperture, in ventral aspect (Fig. 159).

Biology.— Apparently nothing known except collection date of type material – June.

Distribution.— The type locality, in Ohio, is the only one presently known (map 27).

Polycentropus pentus Ross

Map 28; Fig. 160–166

Polycentropus pentus Ross, 1941:71; Ross, 1944:65.

Description.— Fore-wing length of male 5.85 mm; dull grey-brown with alternate pale and dark bands along costal margin, otherwise faintly irrorate. Hind-wing palely tinted grey-brown. Antennae brown. Vertex of head warm red-brown. Spurs yellow-brown. Thorax warm red-brown, to yellow-brown laterally. Legs yellow-brown.

Genitalia. Male. (Fig. 160–164). (Specimen from James Bay, Québec). Males distinguished by ventral lobe of clasper, in lateral aspect (Fig. 160), not acuminate, quite long; by dorsal lobe of clasper arched dorso-posterad, with ventral lobe a short, acuminate tooth immediately at base; by postero-ventral edge of preanal appendage with small, triangular process; by dorsal process of preanal appendage sharply curved at base, remainder linear, with acuminate tip; and by dorsal lobe of clasper, in ventral aspect (Fig. 163), not visible.

Genitalia. Female. (Fig. 165–166). (Specimen from St Hippolyte, Québec). Females recognised by lateral lobe of sternum VIII, in lateral aspect, bluntly acuminate distally, with sinuate dorsal edge, shallowly angled ventral edge; by segment X not sclerotised to dorsum, with ventral extremity adjacent to base of lateral lobe of sternum VIII; and by sclerotised vulval scale, in ventral aspect (Fig. 166), not quite semi-circular, but dome-shaped in outline.

Biology.— Little known, but the larvae appear to inhabit both standing waters and the smaller flowing waters. Canadian flight season dates range from June 2 to September 7.

Distribution.— Widely distributed in northeastern North America, from Tennessee to Minnesota, northern Québec, and Cape Breton Island (map 28). In Canada the species has been recorded from the north shore of Lake Superior east to Cape Breton and far eastern Québec; also north along the east coast of Hudson's Bay.

Polycentropus pixi Ross

Map 29; Fig. 122–126

Polycentropus pixi Ross, 1944:66.

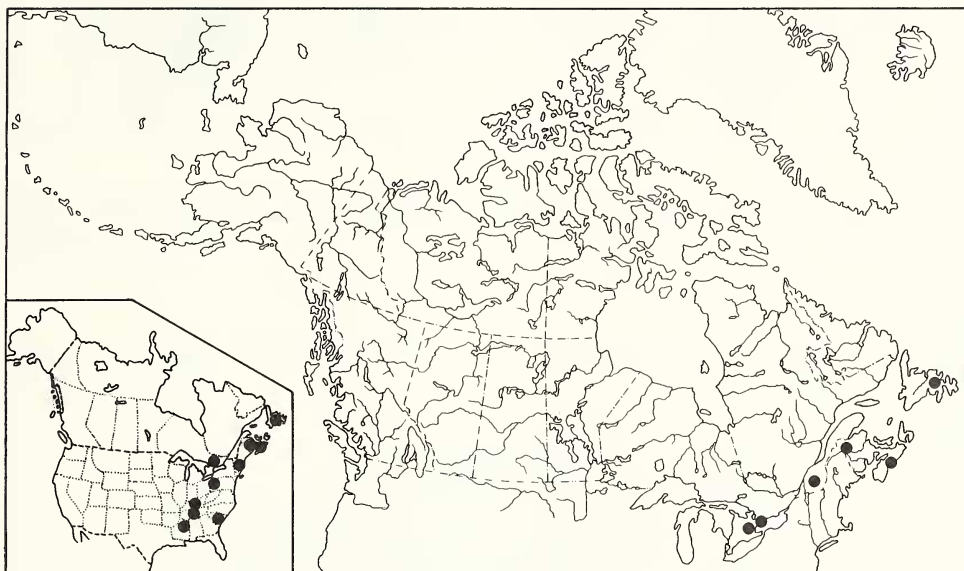
Description.— Fore-wing length of male 5.54 mm; dull brownish grey, with hyaline patches at cross-veins R3+4-M1+2, M1+2-M3, and M-Cu1+2. Hind-wing tinted pale brownish grey. Antennae dull brown. Vertex of head deep brown. Lateral spur of all mid- and hind-leg pairs shorter than mesal companion. Thorax deep brown, to paler laterally. Legs straw.

Genitalia. Male. (Fig. 122–125). (Specimen from Factory Bk, Middlefield, Massachusetts, USA). Males distinguished by ventral lobe of clasper, in lateral aspect (Fig. 122), with base wide, distal half narrow, of uniform width, distally rounded, with acuminate secondary lobe on mesal face; by dorsal lobe of clasper arched dorso-posterad, with small, acuminate, tooth-like ventral lobe; by ventral body of preanal appendage with posterior edge broadly produced posterad, the process distally rounded; by dorsal process of preanal appendage relatively short, slender, of uniform width, with distal half linear, abruptly tapered to acuminate tip; and by dorsal lobe of clasper, in ventral aspect (Fig. 125), barely, if at all, visible mesad of ventral lobe.

Genitalia. Female. Unknown.

Biology.— Nothing known, except the available flight season dates, from June 18 to 21, which is minimally informative.

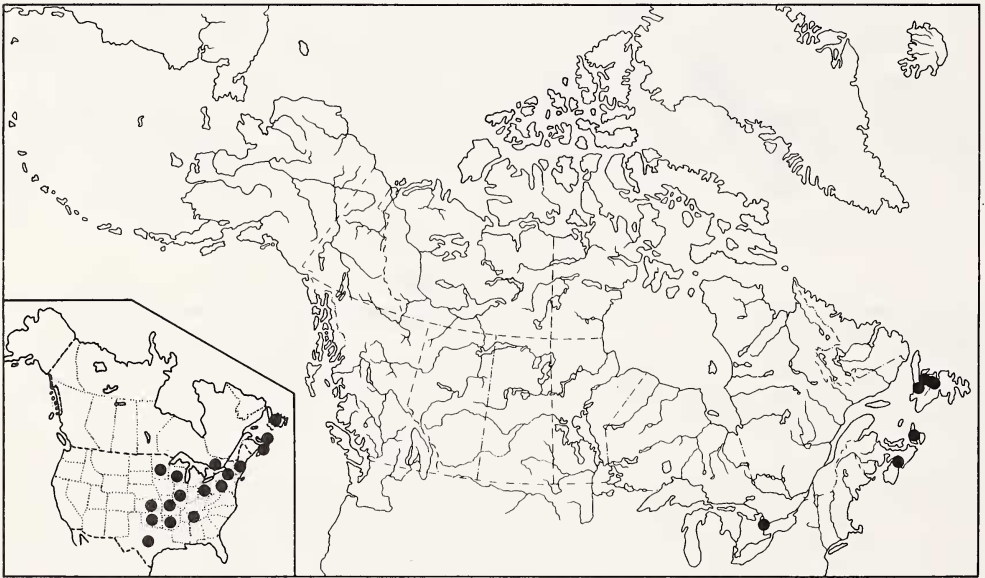
Distribution.— Presently very restricted, to New Hampshire, New York State, and Massachusetts (map 29). Not yet known from Canada.



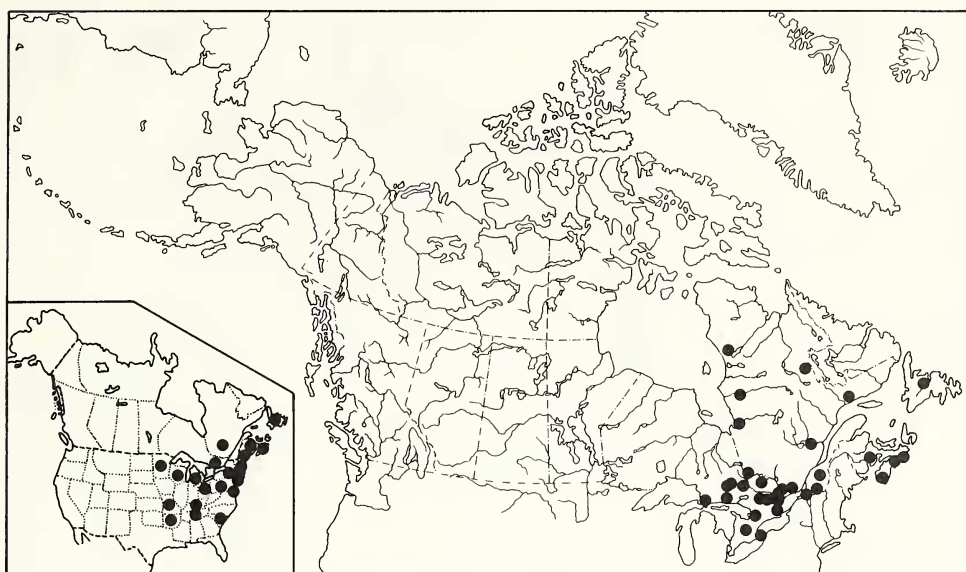
Map 21. Collection localities for *Polycentropus blicklei* Ross and Yamamoto in Canada, with known distribution in North America by state or province.



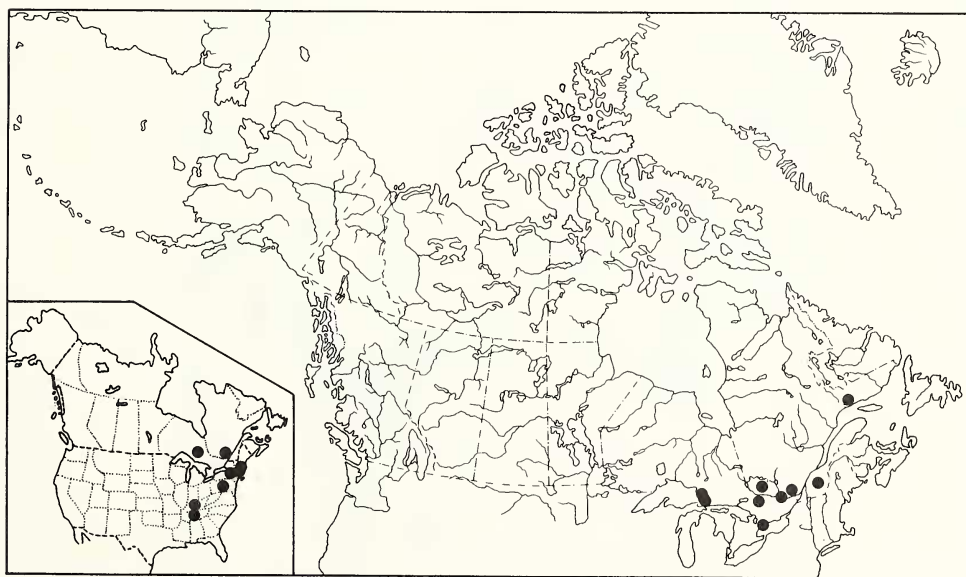
Map 22. Collection localities for *Polycentropus carolinensis* Banks in Canada, with known distribution in North America by state or province.



Map 23. Collection localities for *Polycentropus centralis* Banks in Canada, with known distribution in North America by state or province.



Map 24. Collection localities for *Polycentropus confusus* Hagen in Canada, with known distribution in North America by state or province.



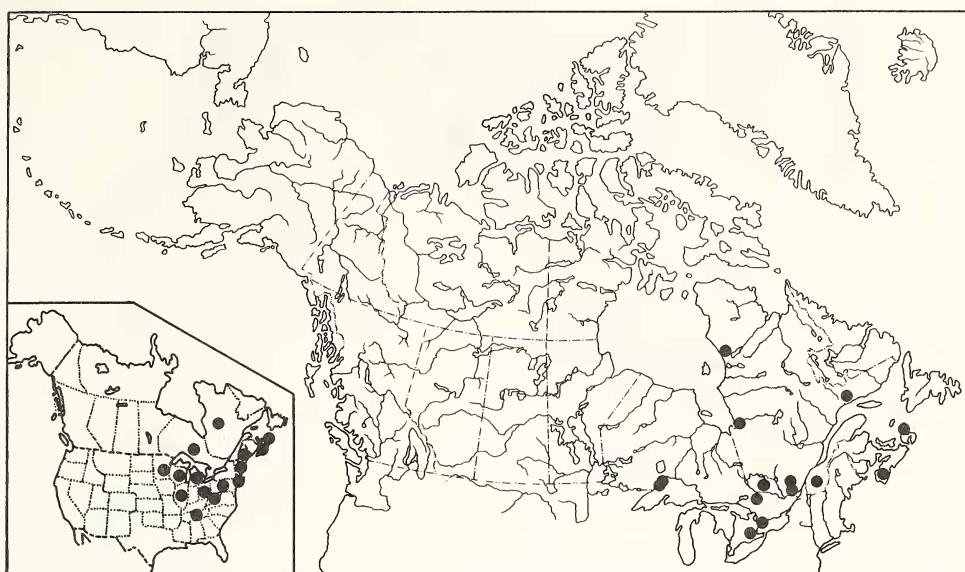
Map 25. Collection localities for *Polycentropus elarus* Ross in Canada, with known distribution in North America by state or province.



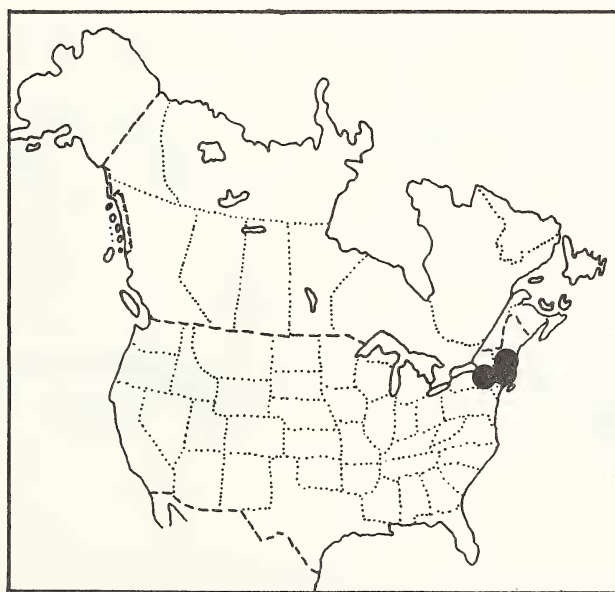
Map 26. Collection localities for *Polycentropus maculatus* Banks in Canada, with known distribution in North America by state or province.



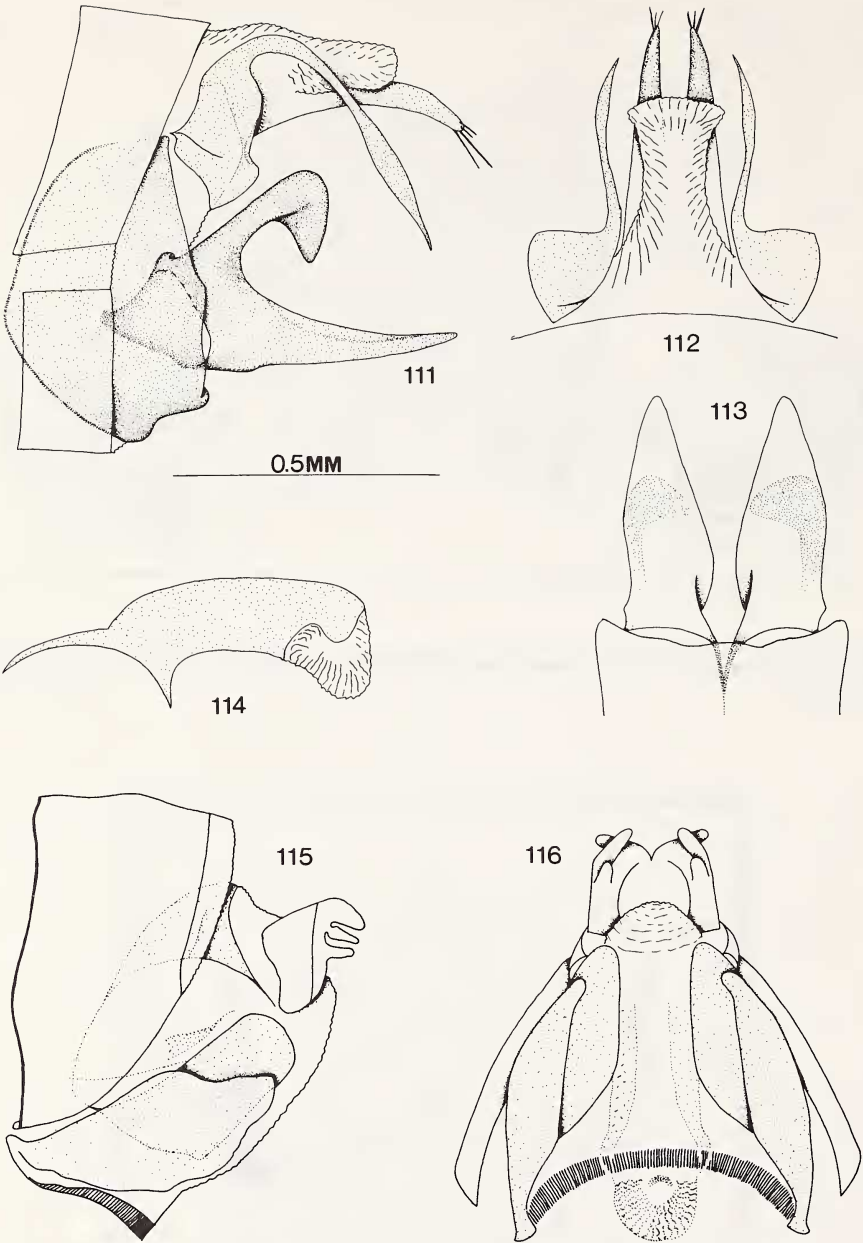
Map 27. Known distribution of *Polycentropus neiswanderi* Ross in North America, by state.



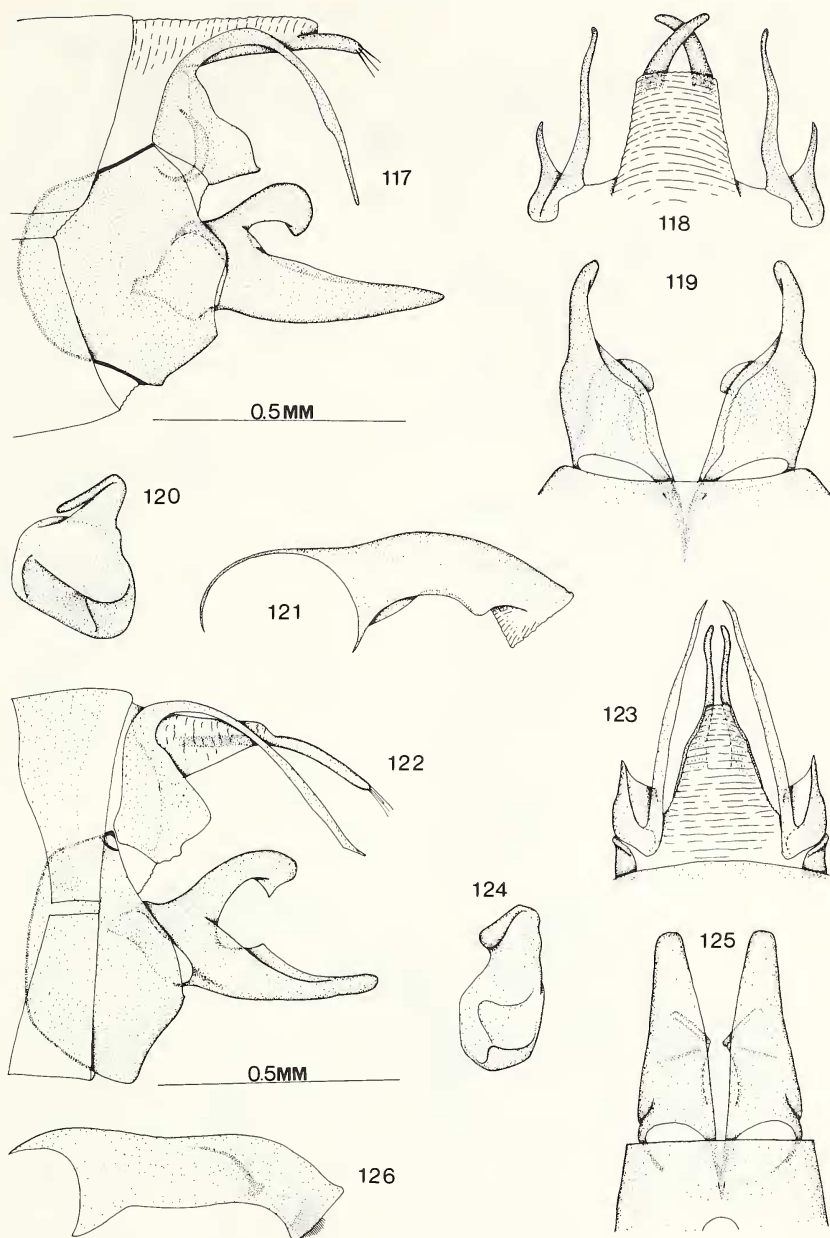
Map 28. Collection localities for *Polycentropus pentus* Ross in Canada, with known distribution in North America by state or province.



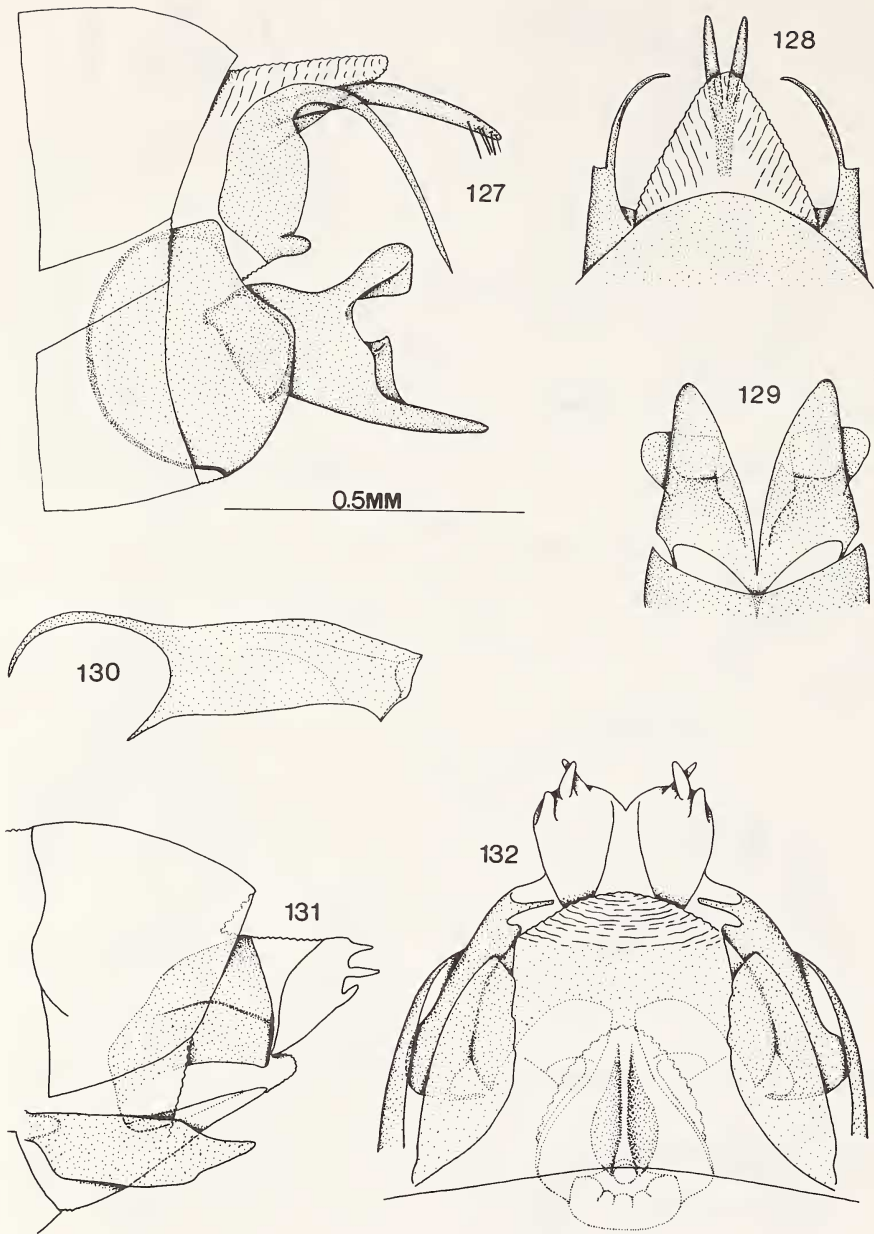
Map 29. Known distribution of *Polycentropus pixi* Ross in North America, by state.



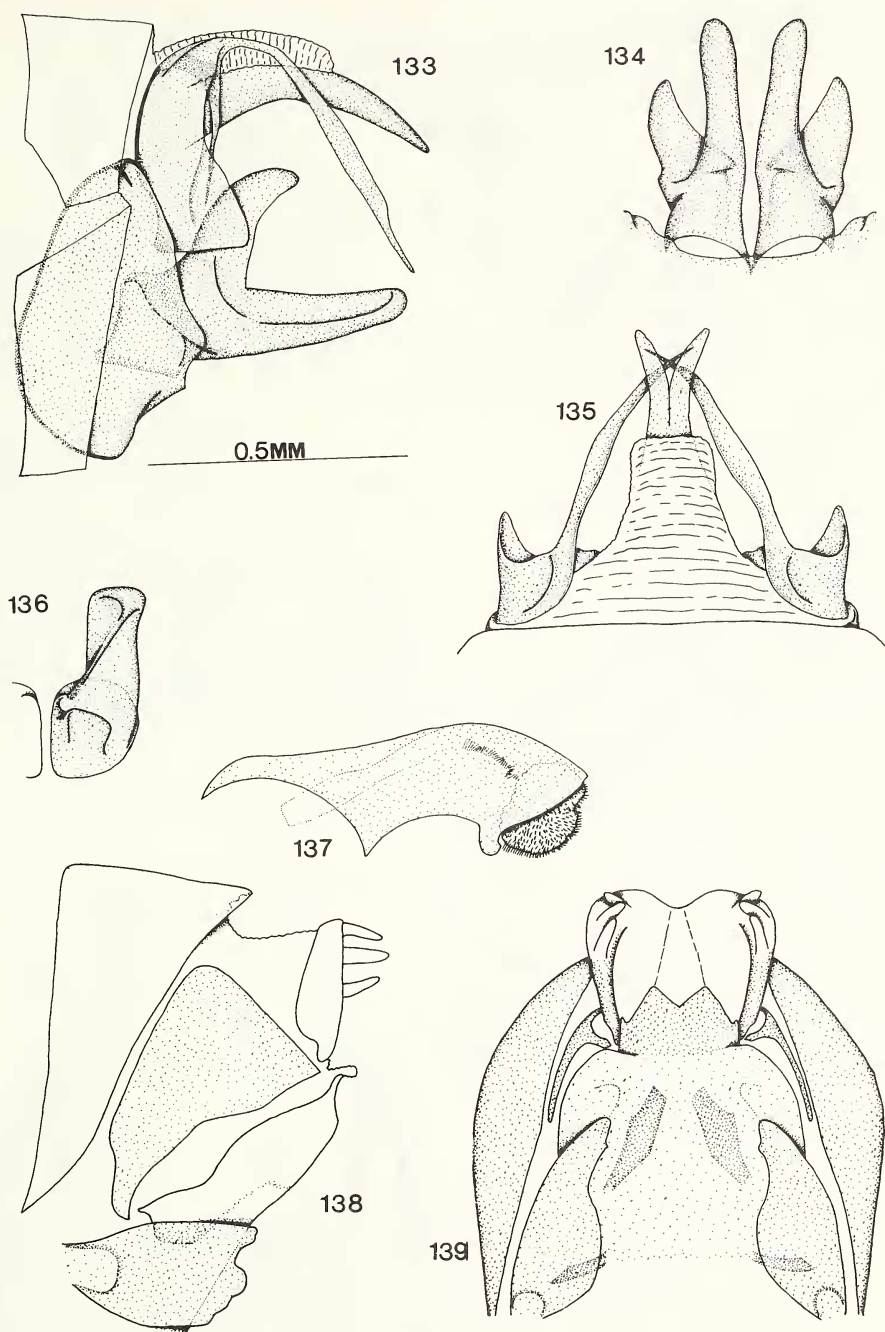
Figs. 111-116. *Polycentropus blicklei* Ross & Yamamoto: 111, genital capsule of male, lateral aspect; 112, genital capsule of male, dorsal aspect; 113, genital capsule of male, ventral aspect; 114, aedeagus of male, lateral aspect; 115, genital segments of female, lateral aspect; 116, genital segments of female, ventral aspect.



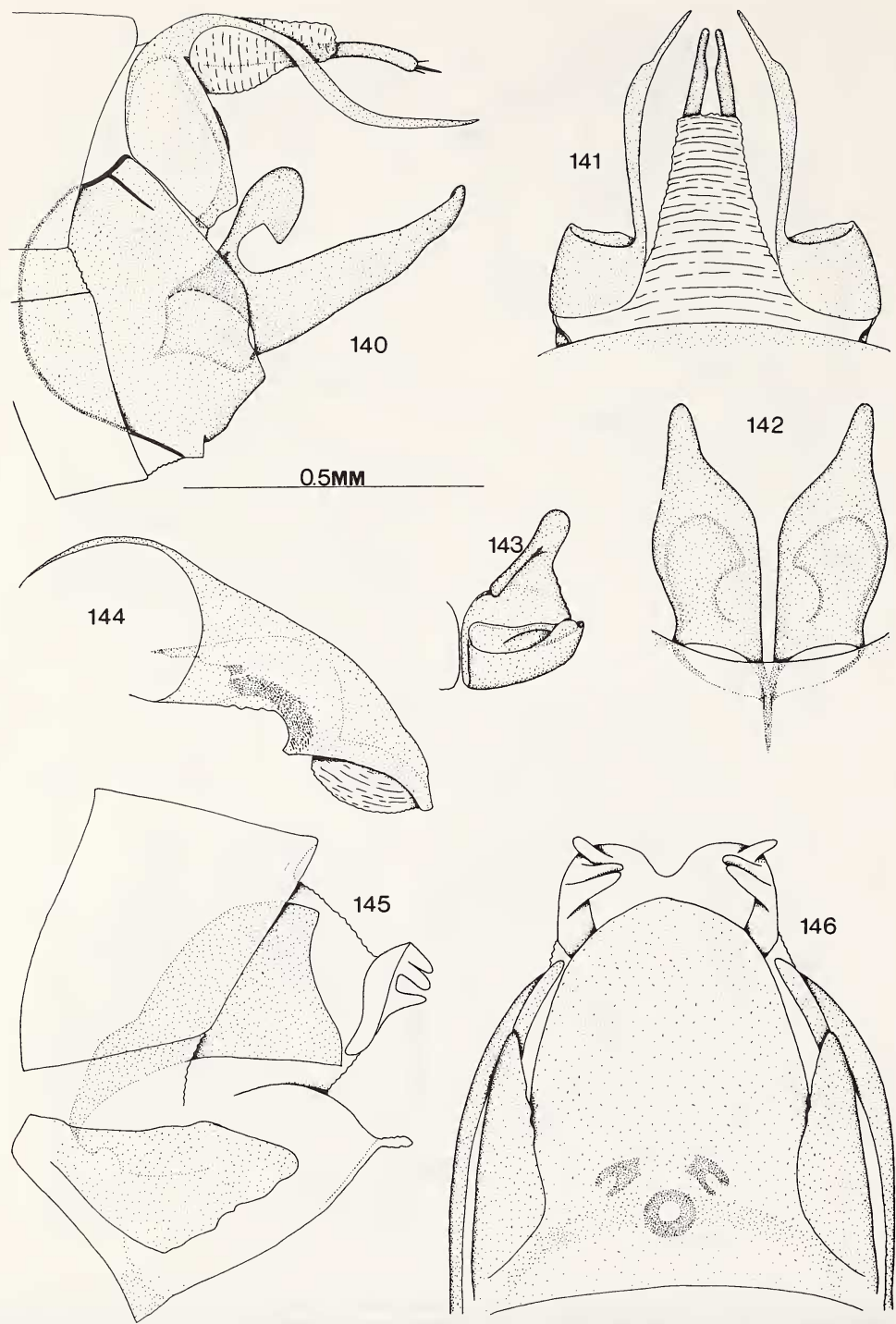
Figs. 117-125. 117-121, *Polycentropus carolinensis* Banks: 117, genital capsule of male, lateral aspect; 118, genital capsule of male, dorsal aspect; 119 genital capsule of male, ventral aspect; 120, right inferior appendage (clasper) of male, posterior aspect; 121, aedeagus of male, lateral aspect. 122-125, *Polycentropus pixi* Ross: 122, genital capsule of male, lateral aspect; 123, genital capsule of male, dorsal aspect; 124, right inferior appendage (clasper) of male, posterior aspect; 125, genital capsule of male, ventral aspect; 126, aedeagus of male, lateral aspect.



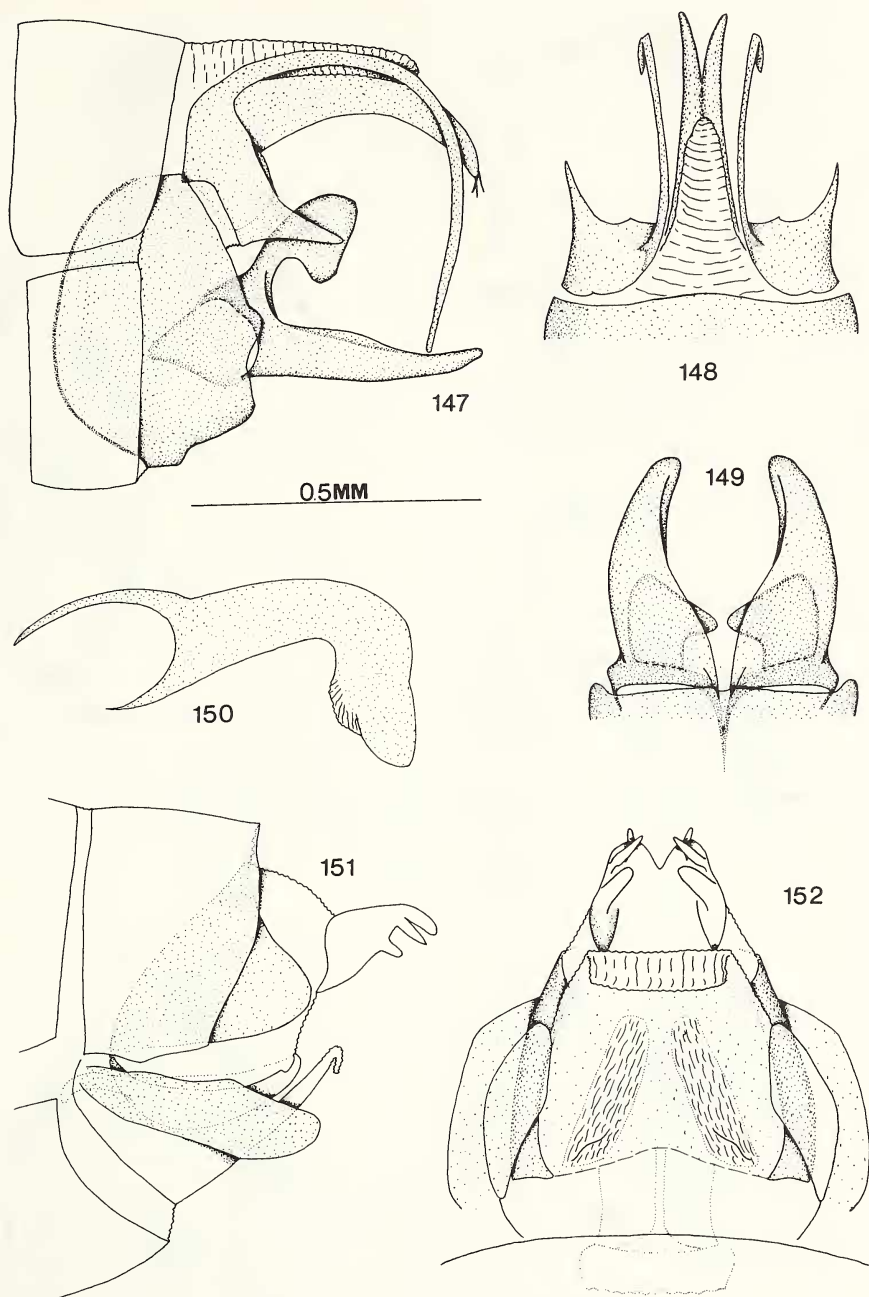
Figs. 127-132, *Plycentropus centralis* Banks: 127, genital capsule of male, lateral aspect; 128, genital capsule of male, dorsal aspect; 129, genital capsule of male, ventral aspect; 130, aedeagus of male, lateral aspect; 131, genital segments of female, lateral aspect; 132, genital segments of female, ventral aspect.



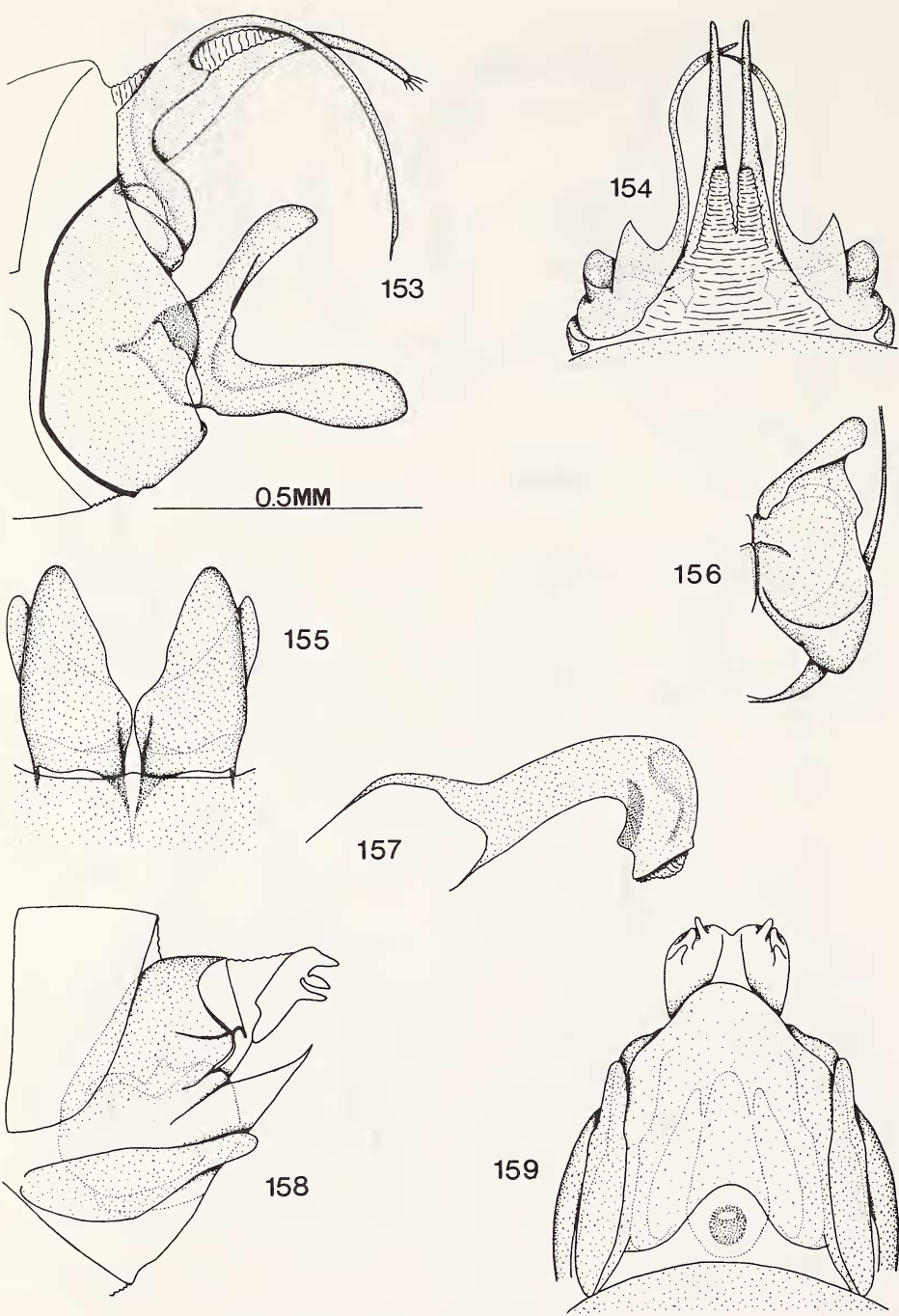
Figs. 133- 139, *Polycentropus confusus* Hagen: 133, genital capsule of male, lateral aspect; 134, genital capsule of male, ventral aspect; 135, genital capsule of male, dorsal aspect; 136, right inferior appendage (clasper) of male, posterior aspect; 137, aedeagus of male, lateral aspect; 138, genital segments of female, lateral aspect; 139, genital segments of female, ventral aspect.



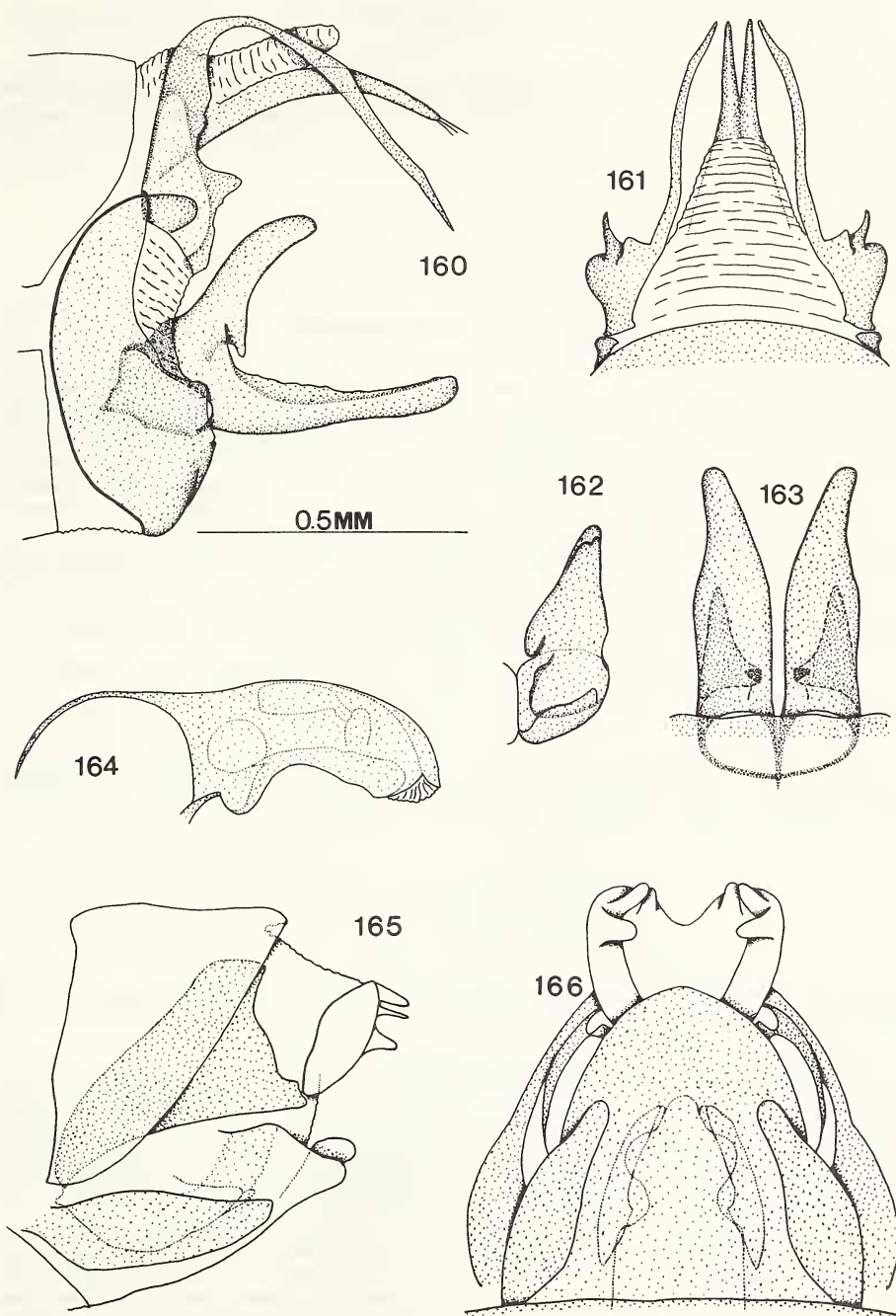
Figs. 140-146, *Polycentropus elarus* Ross: 140, genital capsule of male, lateral aspect; 141, genital capsule of male, dorsal aspect; 142, genital capsule of male, ventral aspect; 143, right inferior appendage (clasper) of male, posterior aspect; 144, aedeagus of male, lateral aspect; 145, genital segments of female, lateral aspect; 146, genital segments of female, ventral aspect.



Figs. 147-152, *Polycentropus maculatus* Banks: 147, genital capsule of male, lateral aspect; 148, genital capsule of male, dorsal aspect; 149, genital capsule of male, ventral aspect; 150, aedeagus of male, lateral aspect; 151, genital segments of female, lateral aspect; 152, genital segments of female, ventral aspect.



Figs. 153-159, *Polycentropus neiswanderi* Ross: 153, genital capsule of male, lateral aspect; 154, genital capsule of male, dorsal aspect; 155, genital capsule of male, ventral aspect; 156, right inferior appendage (clasper) of male, posterior aspect; 157, aedeagus of male, lateral aspect; 158, genital segments of female, lateral aspect; 159, genital segments of female, ventral aspect.



Figs. 160-166, *Polycentropus pentus* Ross: 160, genital capsule of male, lateral aspect; 161, genital capsule of male, dorsal aspect; 162, right inferior appendage (clasper) of male, posterior aspect; 163, genital capsule of male, ventral aspect; 164, aedeagus of male, lateral aspect; 165, genital segments of female, lateral aspect; 166, genital segments of female, ventral aspect.

SPECIES GROUP D

The males of this group are characterised by postero-ventral edge of segment IX with distinct, acuminate (in lateral aspect) projection posterad; by clasper simple, not bilobed; by preanal appendage simple, without lobes or processes; and by intermediate appendage distinctly bilobed.

Polycentropus aureolus (Banks)

Map 30; Fig. 167–172

Plectrocnemia aureola Banks, 1930a:130; Betten, 1934:215; Milne, 1936:86, 88.

Polycentropus aureolus; Ross, 1944:64.

Description.— Fore-wing length of male 7.57 mm; translucent pale yellow-brown. Antennae dull grey-brown. Vertex of head dull straw. Spurs brown; lateral spur of both mid-leg pairs, and of hind-leg apical pair, notably shorter than mesal companion. Thorax dull grey-brown to cream, to greyish straw laterally. Legs dull straw, to pale brown distally.

Genitalia. Male. (Fig. 167–170). (Specimen from Shunda Ck, two miles E of Nordegg, Alberta). Males distinguished by lobes of intermediate appendage, in lateral aspect (Fig. 167), large, wide, acuminate, directed posterad or postero-ventrad; by postero-ventral process of segment IX with small, concealed, acuminate tooth mesally on floor; by clasper large, unmodified, directed dorsad, slightly expanded distally; and by preanal appendage semi-elliptical.

Genitalia. Female. (Fig. 171–172). (Specimen from marsh at km 164.2, Haines Hwy, British Columbia). Females recognised by segment X not sclerotised to dorsum, ventral extremity concealed by lateral lobe of sternum VIII, and with short, rounded process on posterior edge which partly overlaps segment XI lateral wall (Fig. 171).

Biology.— Apparently a species of flowing and standing waters. I have taken adults of this species at a high altitude pond with quaking margin and soft, sulphurous-looking bottom; at a deep, slow, winding foothills stream; and adjacent to a large mountain river. Flight season dates for Canada range from June 13 to August 15, with predominance in late June and July.

Distribution.— Transcontinental from Newfoundland to southern British Columbia and northern Yukon (map 30), with records from most of the northern tier of the United States. In Canada this species appears to be general throughout the forested areas.

Polycentropus crassicornis Walker

Map 31; Fig. 173–178

Polycentropus crassicornis Walker, 1852:101; Ross, 1944:64.

Plectrocnemia crassicornis; Betten, 1934:218; Milne, 1936:88 (as synonym of *Neureclipsis crepuscularis*); Betten & Mosely, 1940:36, 38.

Plectrocnemia adironica Banks, 1914:256; Betten & Mosely, 1940:36, 38.

Polycentropus confusa Hagen, 1861:293 (part); Betten & Mosely, 1940:36, 38.

Description.— Fore-wing length of male 8.19 mm; purple-brown, with pale grey-brown irrorations throughout (weakest in basal quarter). Hind-wing palely tinted. Female fore-wing very pale purple-brown to almost hyaline; with white spots at distal extremities of distal cells; hind-wing hyaline. Antennae purple-brown, with white boundary at annular joints. Vertex of head purple-brown, warts slightly paler. Preapical spur of fore-tibia only half as long as apical spurs; equal in female. Thorax brown, to pale red-brown laterally. Legs deep yellow-brown to straw.

Genitalia. Male. (Fig. 173–176). (Specimen from Annapolis Royal, Nova Scotia). Males recognised by postero-ventral process of segment IX, in lateral aspect (Fig. 173), with large, visible median keel on dorsal surface; by clasper complex, with triangular disto-ventral lobe surmounted by lateral longitudinal flange; by preanal appendage longer than wide, almost rectangular, generally angular; by ventral lobe of intermediate appendage curved postero-ventrad, dorsal lobe curved dorso-anterad; and by postero-ventral process of segment IX, in ventral aspect (Fig. 175), roughly acute-triangular in outline.

Genitalia. Female. (Fig. 177–178). (Specimen from Brierly Bk, Antigonish Co., Nova Scotia). Females distinguished by segment X sclerotised to dorsum, at one point (Fig. 177), with ventral extremity concealed by lateral lobe of sternum VIII, and with only a shallow, triangular extension of posterior edge to overlap segment XI lateral wall.

Biology.— A species of lakes, bogs, creeks, and at least small rivers. Flight dates from Canada range from May 13 to July 11, with predominance in June. Apparently an early,

seasonally somewhat restricted species.

Distribution.— Widespread, being known from Idaho and western Saskatchewan to Florida and Nova Scotia (map 31). In Canada only scattered records are yet available, the majority being from southern Québec and Ontario.

Polycentropus jenula Denning

Map 32; Fig. 179–183

Polycentropus jenula Denning; Denning & Sykora, 1966:1219.

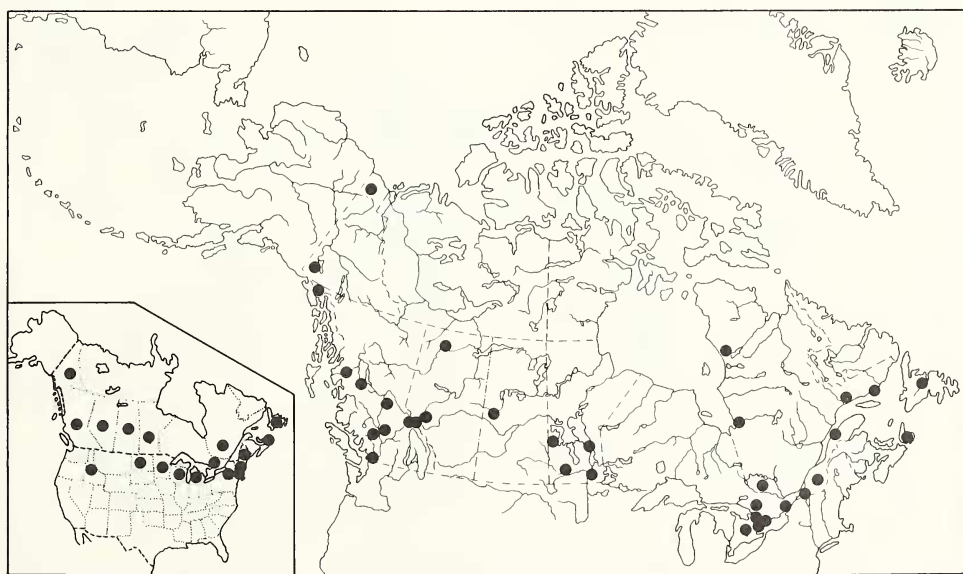
Description.— Fore-wing length of male 7.68 mm; pale brownish yellow, faintly irrorate. Antennae brownish yellow. Vertex of head dull brown, darker between eyes. Spurs yellow. Thorax deep reddish brown, to paler laterally. Legs straw.

Genitalia. Male. (Fig. 179–183). (Specimen from near Lethbridge, Alberta – holotype). Males of this distinctive species recognised by postero-ventral process of segment IX, in lateral aspect (Fig. 179), without median keel or tooth on dorsal surface, the process tapered gradually off segment IX; by clasper directed posterad, arched slightly dorsad, distally rounded, not tapered; by preanal appendage polygonal, directed somewhat postero-dorsad; and by ventral lobe of intermediate appendage sinuate, slender, dark, directed postero-ventrad, and dorsal lobe curved latero-anterad, short, dark, rather broad for its length.

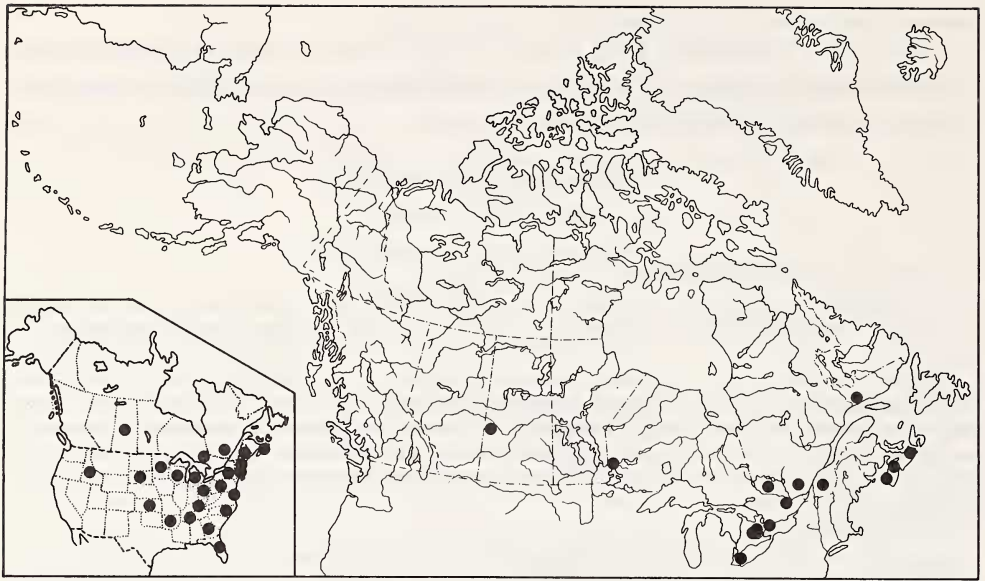
Genitalia. Female. Unknown.

Biology.— Unknown except for collection date of the only known specimen – July 13.

Distribution.— Presently known only from the type locality in southern Alberta, which is not precisely known.



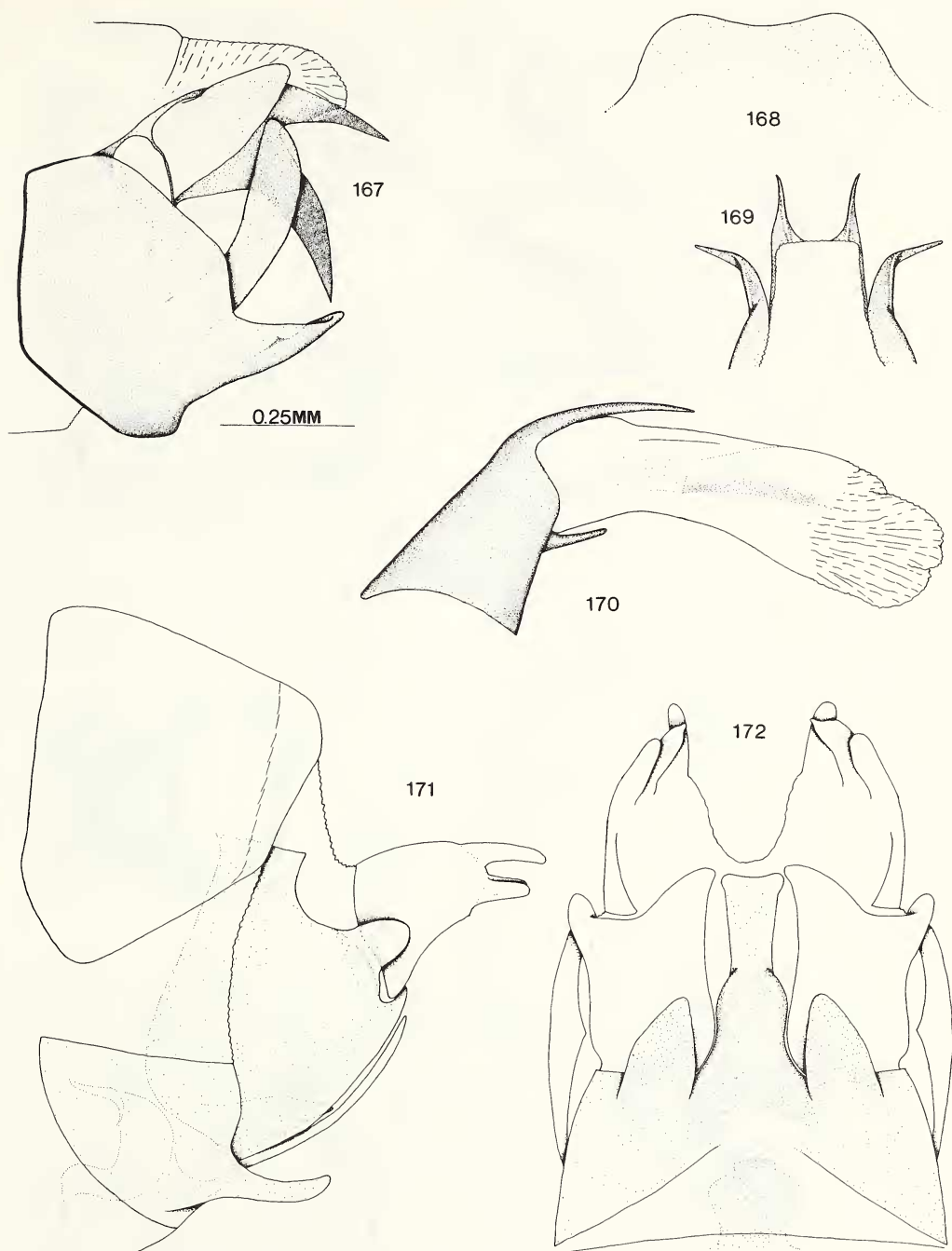
Map 30. Collection localities for *Polycentropus aureolus* (Banks) in Canada, with known distribution in North America by state or province.



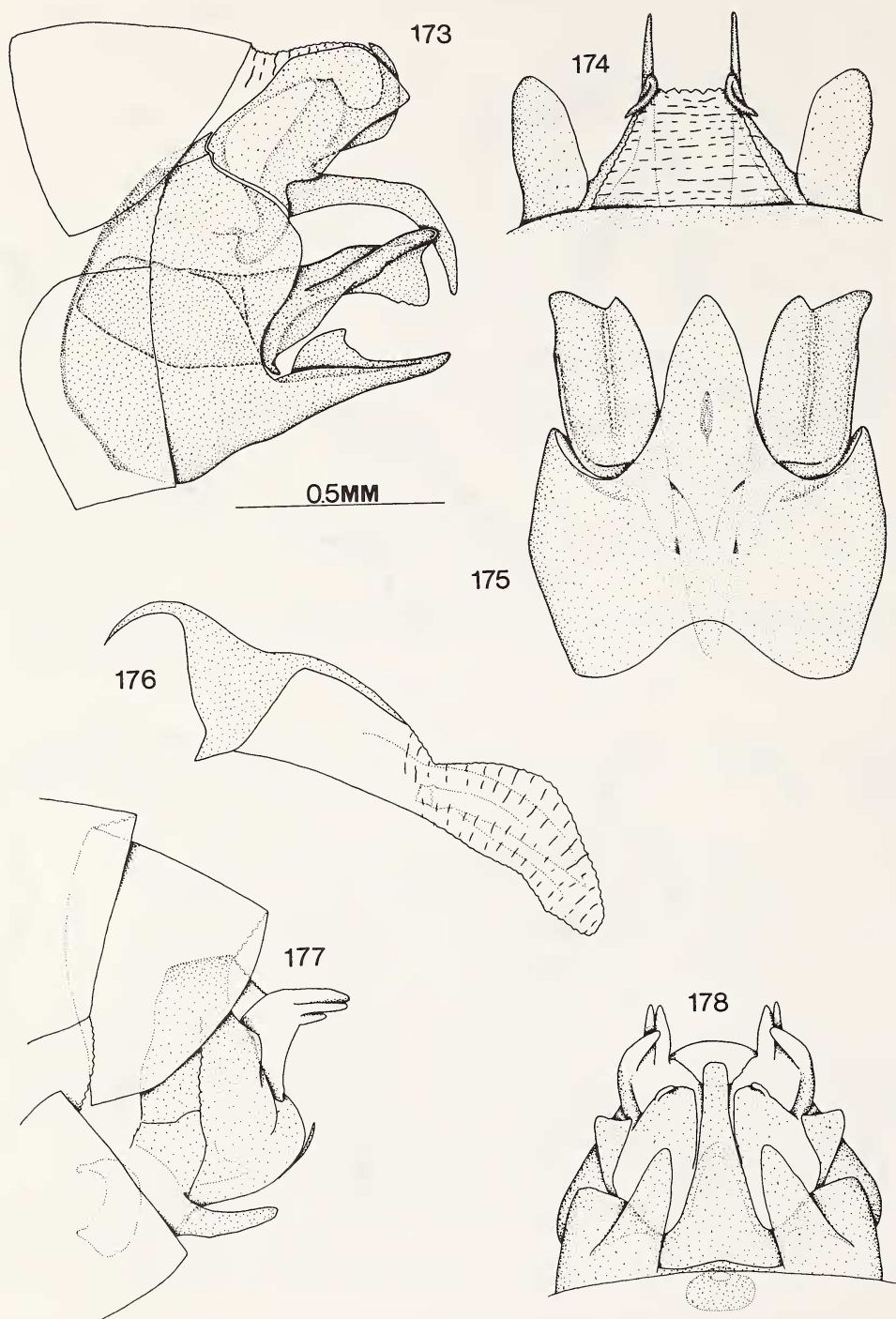
Map 31. Collection localities for *Polycentropus crassicornis* Walker in Canada, with known distribution in North America by state or province.



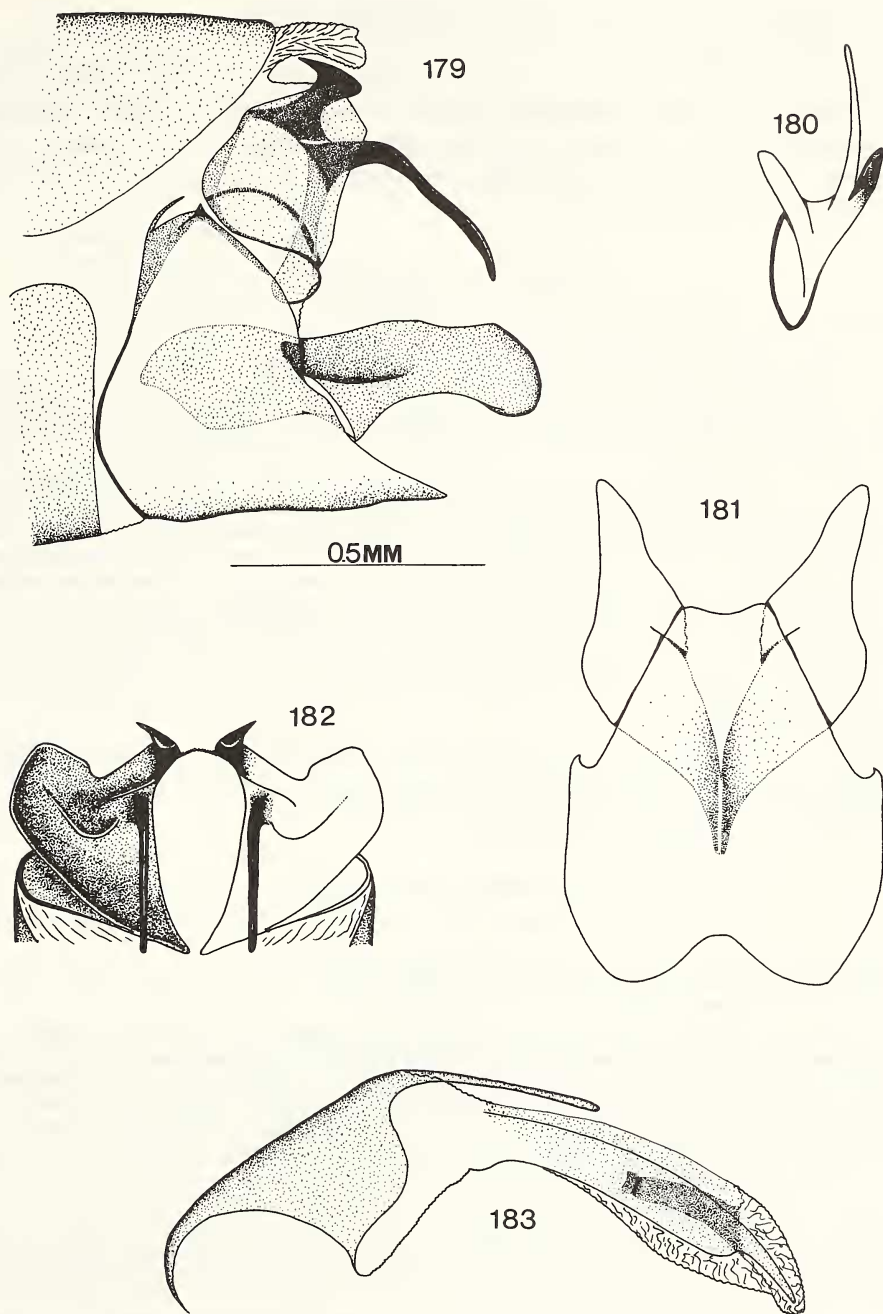
Map 32. Collection localities for *Polycentropus jenula* Denning in Canada, with known distribution in North America by state or province.



Figs. 167-172, *Polycentropus aureolus* (Banks): 167, genital capsule of male, lateral aspect; 168, genital capsule of male, postero-ventral edge, ventral aspect; 169, segment X and intermediate appendages of male, dorsal aspect; 170, aedeagus of male, lateral aspect; 171, genital segments of female, lateral aspect; 172, genital segments of female, ventral aspect.



Figs. 173-178, *Polycentropus crassicornis* Walker: 173, genital capsule of male, lateral aspect; 174, genital capsule of male, dorsal aspect; 175, genital capsule of male, ventral aspect; 176, aedeagus of male, lateral aspect; 177, genital segments of female, lateral aspect; 178, genital segments of female, ventral aspect.



Figs. 179-183, *Polycentropus jenula* Denning: 179, genital capsule of male, lateral aspect; 180, right intermediate and preanal appendages of male, dorsal aspect; 181, genital capsule of male, ventral aspect; 182, intermediate and preanal appendages of male, posterior aspect; 183, aedeagus of male, lateral aspect.

SPECIES GROUP E

Males of this group are characterised by intermediate appendage, in lateral aspect, curved postero-ventrad, long, slender, perhaps with secondary processes basally; by preanal appendage either apparently with two articles, or with distal lobe segregated from base by sharp narrowing, or both; and, in most species dealt with here, by dorso-mesal lobe of clasper with distinct notch at posterior end of base.

Polycentropus chellus Denning

Map 33; Fig. 184–187

Polycentropus chellus Denning, 1964:243.

Due to the advanced state of disintegration of the holotype, the only known specimen, when received on loan, I give here Denning's original description as it applies to the general habitus of the species.

'Length ((?)) 8 mm. Wings fuscous, pubescence causing indistinct markings near apex; head, thorax, abdomen dark brown; appendages and antennae brown. Fourth sternite bears a broad flat process arising from dorso-cephalad corner which gradually tapers to a caudad-curved apex, and extends to the dorsal margin of fourth tergite'

Genitalia. Male. (Fig. 184–187). (Specimen from Fargo, North Dakota, USA – holotype). The genitalia, also, were in rather disastrous condition, being largely disarticulated. Despite Denning's mention of claspers in his original description, it is evident from his drawing that the claspers were, as here, already missing. Segment IX (Fig. 184–187) has all free margins bordered by a heavy dark band; the postero-ventral margin is deeply, broadly incised twice (Fig. 187) to give the appearance of the letter W, in outline. The intermediate appendage tip is coincident with that of the preanal appendage, in lateral aspect (Fig. 186). The preanal appendage, in lateral aspect, appears to be of two articles, with the distal blade much narrower than the basal portion.

Genitalia. Female. Unknown.

Biology.— Nothing known except collection date of the holotype – August 1. This was a light trap collection, and the condition of the type can be largely attributed to that fact.

Distribution.— North Dakota (map 33).

Polycentropus flavus (Banks)

Map 34; Fig. 193–199

Holocentropus flavus Banks, 1908:66; Betten, 1934:222; Milne, 1936:87.*Polycentropus flavus*; Ross, 1944:68.

Description.— Fore-wing length of male 5.77 mm; bright golden brown. Hind-wing faintly tinted golden brown. Antennae brownish cream. Vertex of head dark brown, to paler posteriorly. Spurs orange-brown; lateral spur of each mid-leg pair notably shorter than mesal companion. Thorax dark brown, to orange-brown laterally. Legs brownish yellow.

Genitalia. Male. (Fig. 193–197). (Specimen from Cold Ck, Hwy 16, Nojack, Alberta). Males recognised by dorso-mesal lobe of clasper without notch at posterior end of base (Fig. 193); by postero-ventral angle of clasper, in lateral aspect (Fig. 193), broad, well rounded; by preanal appendage apparently of two articles, the distal portion narrowed from both top and bottom edges, short, broad, turned ventrad; and by intermediate appendage with basal part horizontal, distal portion curved ventro-anterad, tip almost coincident with posterior edge of clasper (at rest).

Genitalia. Female. (Fig. 198–199). Females distinguished by lateral lobe of sternum VIII, in lateral aspect (Fig. 198), longer than wide, tapered distad to acuminate tip, both edges even; by segment X not sclerotised to dorsum, far removed from lateral lobe of sternum VIII; and by protuberance between lateral lobes of sternum VIII, in ventral aspect (Fig. 199), directed posterad, in outline shaped like a bell-curve.

Biology.— Collection records indicate clearly that this is a species of standing and flowing waters. I have taken it in sedge-fringed subalpine ponds; large, stony, boreal lakes; rushing mountain torrents; slow, winding, silty creeks; and larger rivers. Truly a ubiquitous species of little discrimination. Canadian flight season dates range from June 3 to August 22, with predominance in late June and July.

Distribution.— Continent-wide, from Alaska and California to Newfoundland, with a southward extension to Texas (map 34). In Canada this species seems to be limited northward only by tree line.

Polycentropus glacialis (Ross)

Map 35; Fig. 200–206

Holocentropus glacialis Ross, 1938b:135.

Polycentropus glacialis; Ross, 1944:68.

Holocentropus sp.; Betten, 1934:223; Ross, 1944:68.

Description.— Fore-wing length of male 6.59 mm; light reddish brown, no evident pattern. R2+3 of hind-wing unforked. Antennae pale yellow-brown. Vertex of head pale greyish brown. Spurs reddish brown; lateral spur of both mid-leg pairs, and of hind-leg apical pair notably shorter than mesal companion. Thorax uniform dark greyish brown. Legs yellow.

Genitalia. Male. (Fig. 200–204). (Specimen from Fox Lk, Illinois, USA – paratype). Males recognised by clasper, in lateral aspect (Fig. 200), with only a small, rounded postero-ventral extension; by clasper dorso-mesal lobe with distinct notch at posterior end of base; by preanal appendage not apparently of two articles, linear, directed postero-dorsad; and by intermediate appendage short, tapered evenly to thin, blunt tip, gently curved throughout.

Genitalia. Female. (Fig. 205–206). (Specimen from Fox Lk, Illinois, USA). Females distinguished by lateral lobe of sternum VIII, in lateral aspect (Fig. 205), small, longer than wide, sinuate, distally blunt; by segment X sclerotised to dorsum, well removed from lateral lobe of sternum VIII; and by segment X of lateral wall with curved dark band from postero-ventral corner to anterior edge.

Biology.— Poorly known. Ross (1944) records it in Illinois only from glacial lakes, and gives the flight season as May 9 to August 12. Roy & Harper (1979) have recorded the species from the Eastern Townships of Québec on August 16.

Distribution.— Other than the Québec record, this species is known from the States immediately south of the Great Lakes (map 35).

Polycentropus grellus (Milne)

Map 36; Fig. 188–192

Holocentropus grellus Milne, 1936:87, 88.

Polycentropus grellus; Ross, 1944:293.

Description.— Fore-wing length of male 5.46 mm; warm red-brown, no evident pattern. Antennae pale yellowish brown. Vertex of head deep brownish red. Spurs light brown; lateral spur of each mid-leg pair, and of the hind-leg apical pair, notably shorter than mesal partner. Thorax uniform red-brown. Legs pale red-brown to straw.

Genitalia. Male. (Fig. 188–192). (Specimen from Riverhead, Long Island, N.Y., USA). Males recognised by clasper, in lateral aspect (Fig. 199), with postero-ventral angle broadly triangular; by dorso-mesal lobe of clasper with distinct, two-stage notch at posterior end of base; by preanal appendage apparently of two articles, distal portion segregated from basal by sharp declivity, of same width, both parts linear with distal part directed postero-ventrad almost at right angles to basal part; and by intermediate appendage with two processes, of which the dorsal (primary) process is very slender, evenly curved, with tip opposite tip of preanal appendage, and of which the ventral (secondary) process is much shorter, slightly broader, evenly curved.

Genitalia. Female. Unknown.

Biology.— Virtually nothing known. I have flight dates ranging from June 24 to July 19.

Distribution.— Presently known only from the eastern seaboard of the United States, from Long Island to New Hampshire.

Polycentropus interruptus (Banks)

Map 37; Fig. 207–212

Holocentropus interruptus Banks, 1914:257; Betten, 1934:222; Milne, 1936:87.

Polycentropus interruptus; Ross, 1944:69; Schmid, 1980:Fig. 165, 167–172.

Holocentropus orotus Banks, 1914:257; Ross, 1938a:12 (as synonym of *P. interruptus*).

Holocentropus longus Banks, 1914:258; Ross, 1944:69 (as synonym of *P. interruptus*).

Holocentropus sp. 2; Betten, 1934:224; Ross, 1938a:12 (as *P. interruptus*).

Description.— Fore-wing length of male 8.58 mm; golden brown with scattered paler areas. Hind-wing about twice as long as wide, rounded, stubby looking; female normal, 2.5 times as long as wide. Antennae orange-brown. Vertex of head brown. Spurs brown; lateral spur of each mid-leg pair notably shorter than mesal companion. In preapical pair of hind-leg spurs the mesal spur is bent laterad at two-thirds of length. Thorax red-brown, to paler laterally. Legs cream to yellow-brown.

Genitalia. Male. (Fig. 207–210). (Specimen from Skeleton Lk, nr Boyle, Alberta). Males recognised by clasper, in lateral aspect (Fig. 207), with large, acute-triangular disto-ventral lobe, without dorso-mesal lobe; by preanal appendage with distal half differentiated from basal by abrupt ventral narrowing, not by declivity, the appendage not apparently of two articles; and by intermediate appendage of uniform width throughout except for taper near tip, curved irregularly postero-ventrad, with short, rod-like secondary process near base.

Genitalia. Female. (Fig. 211–212). (Specimen from Skeleton Lk, nr Boyle, Alberta). Females distinguished by lateral lobe of sternum VIII, in lateral aspect (Fig. 211), much longer than wide, of more or less uniform width till obliquely truncate distal end; by segment X sclerotised to dorsum, at one point, not close to lateral lobe of sternum VIII; and by straight edged recess between lateral lobes of sternum VIII, in ventral aspect (Fig. 212).

Biology.— Apart from being typical for the genus, Ross (1944) concludes that there is only the one generation per year. Canadian flight season dates range from June 1 to August 29.

Distribution.— From Vancouver Island to Newfoundland with southward extension to Tennessee. There are isolated records from the McKenzie Delta in Canada, and Colorado in the United States (map 37).

Polycentropus melanae (Ross)

Map 38; Fig. 213–215

Holocentropus melanae Ross, 1938b:136.

Polycentropus melanae; Ross, 1944:293.

Description.— Fore-wing length of male 6.40 mm; dark grey-brown with irroration in postero-distal area of wing, and scattered, larger areas of colour alternating with bars of hyaline membrane, especially along costal edge. Hind-wing palely tinted. Antennal annuli half red-brown, half reddish cream. Vertex of head with triangular postero-mesal area with black setae; remainder with silver setae. Pronotum with silver setae. Preapical spur of fore-tibia two-thirds length of apical spurs. Thorax deep purplish brown, to red-brown laterally. Legs grey-brown to straw.

Genitalia. Male. (Fig. 213–215). (Specimen from Lk Kejimikujic National Park, Nova Scotia). Males distinguished by clasper postero-ventral process long, distally rounded, tapered down from full height of clasper; by clasper dorso-mesal lobe with notch at posterior end of base, in lateral aspect (Fig. 213); by lateral face of clasper with folded-over groove from top to bottom; by preanal appendage apparently of two articles, long, curved postero-ventrad; and by intermediate appendage long, narrow, with taper only near base, evenly curved throughout. Note: aedeagus identical to that of *P. flavus* (Fig. 197).

Genitalia. Female. Unknown.

Biology.— Nothing much known. The only flight date I can find is July 3.

Distribution.— Very poorly known. Minnesota, Michigan, New Hampshire, and Nova Scotia (map 38).

Polycentropus milaca Etnier

Map 39; Fig. 216–220

Polycentropus milaca Etnier, 1968:189.

Description.— Fore-wing length of male 5.46 mm; pale reddish brown, no pattern, no hairs. Hind-wing without fl. Spurs dark red-brown; lateral spur of each mid-leg pair, and of hind-leg apical pair, notably shorter than mesal companion. Overall colour light reddish brown – Etnier (1968) states that the single known specimen was cleared in its entirety, hence the above colours are not to be relied upon.

Genitalia. Male. (Fig. 216–220). (Specimen from Link Lk Ranger Stn, Itasca Co., Minnesota, USA – holotype). Males distinguished by clasper, in lateral aspect (Fig. 216), with straight ventral edge, and right-angled postero-ventral corner; by dorso-mesal lobe of clasper with large notch at posterior end of base; by preanal appendage not apparently of two articles, with distal half almost at right angles to basal half, directed postero-ventrad; and by intermediate appendage short, tapered, arched slightly dorsad.

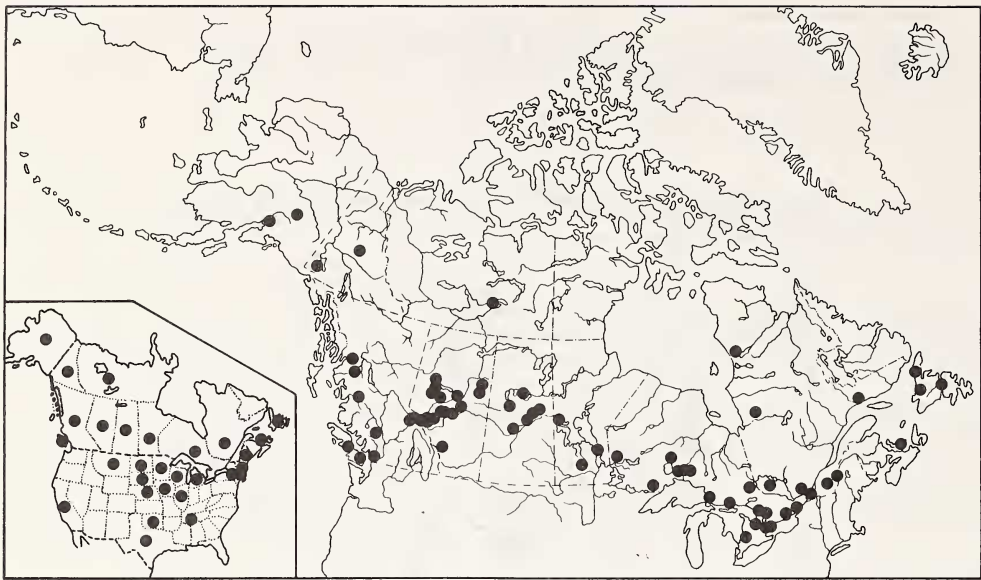
Genitalia. Female. Unknown.

Biology.— Nothing known except the type was taken at a lake on July 18.

Distribution.— Minnesota (map 39).



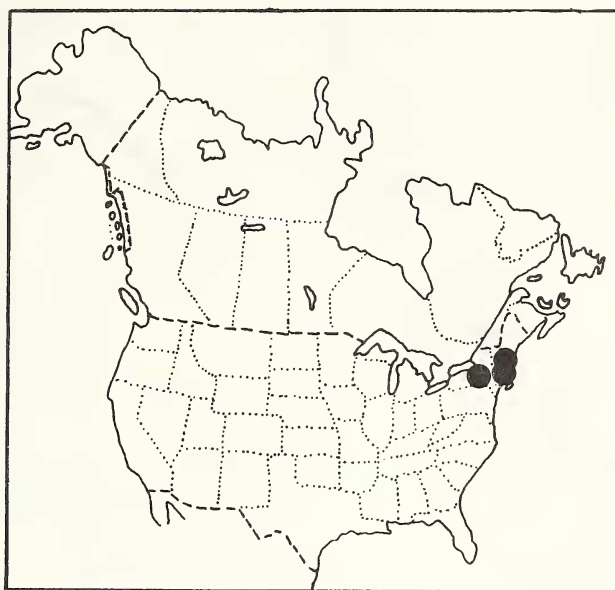
Map 33. Known distribution of *Polycentropus chellus* Denning in North America, by state.



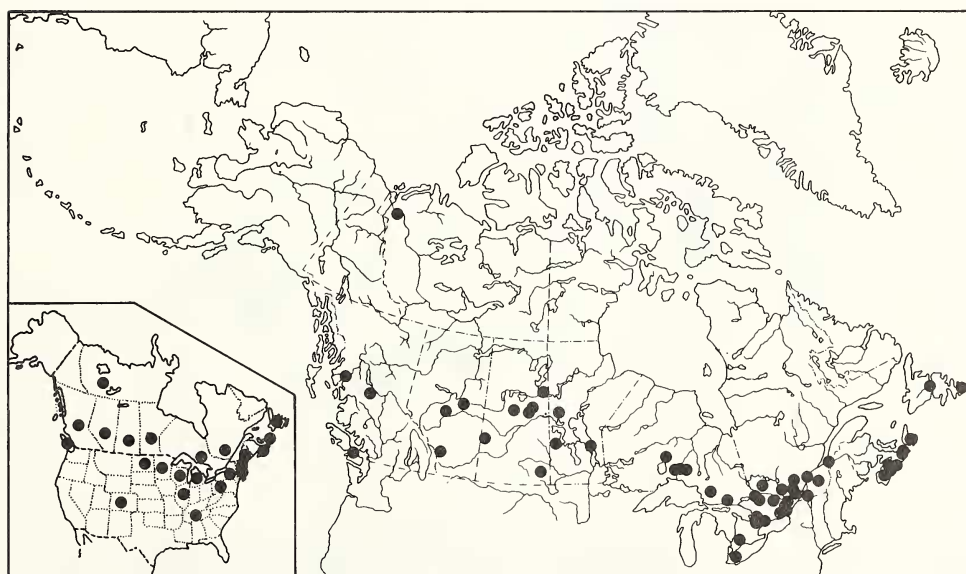
Map 34. Collection localities for *Polycentropus flavus* Banks in Canada and Alaska, with known distribution in North America by state or province.



Map 35. Collection localities for *Polycentropus glacialis* Ross in Canada, with known distribution in North America by state or province.



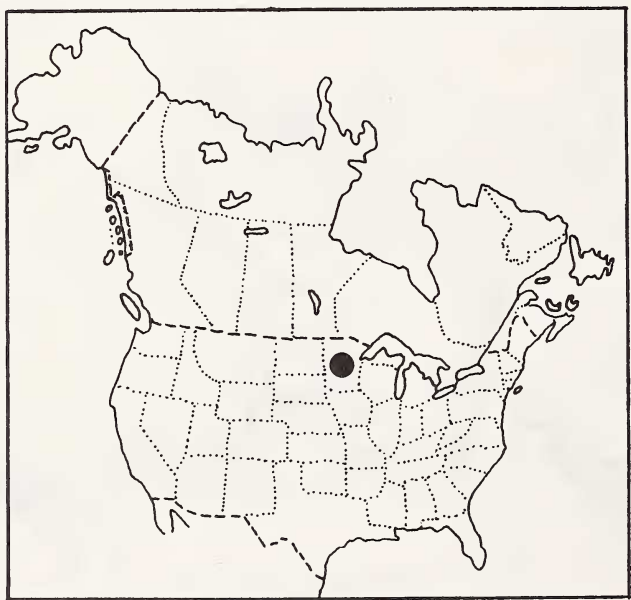
Map 36. Known distribution of *Polycentropus grellus* (Milne) in North America, by state.



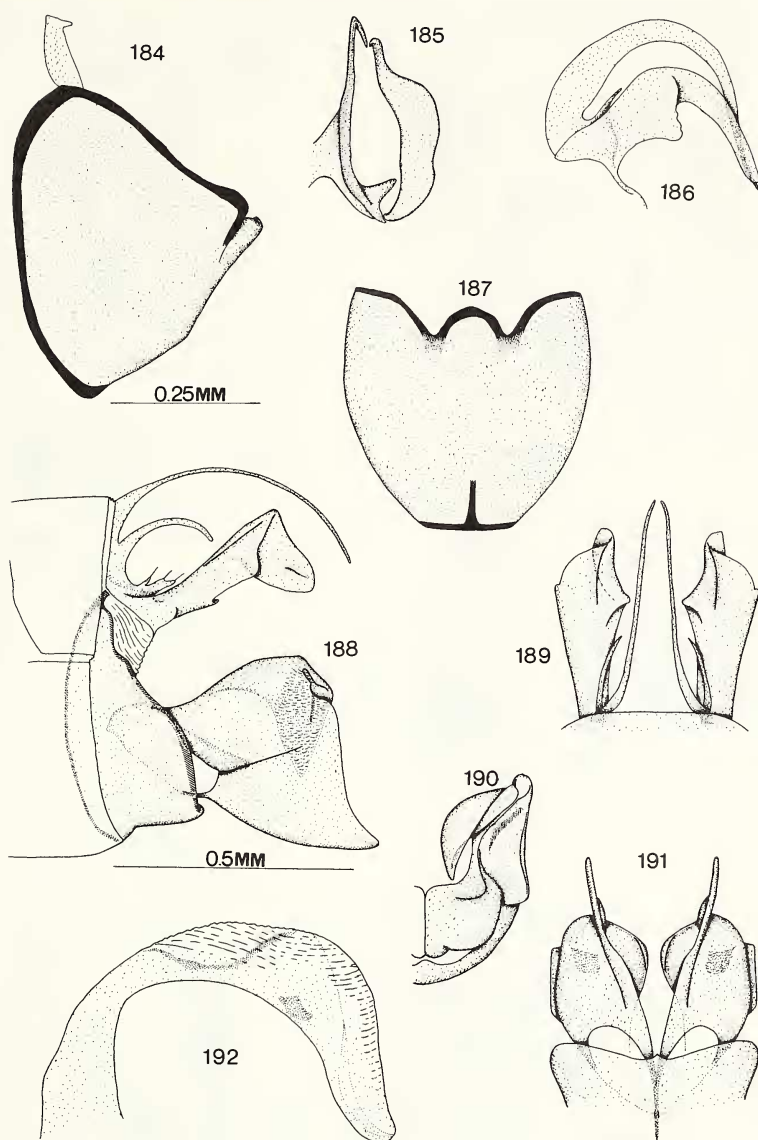
Map 37. Collection localities for *Polycentropus interruptus* Banks in Canada, with known distribution in North America by state or province.



Map 38. Collection localities for *Polycentropus melanae* Ross in Canada, with known distribution in North America by state or province.

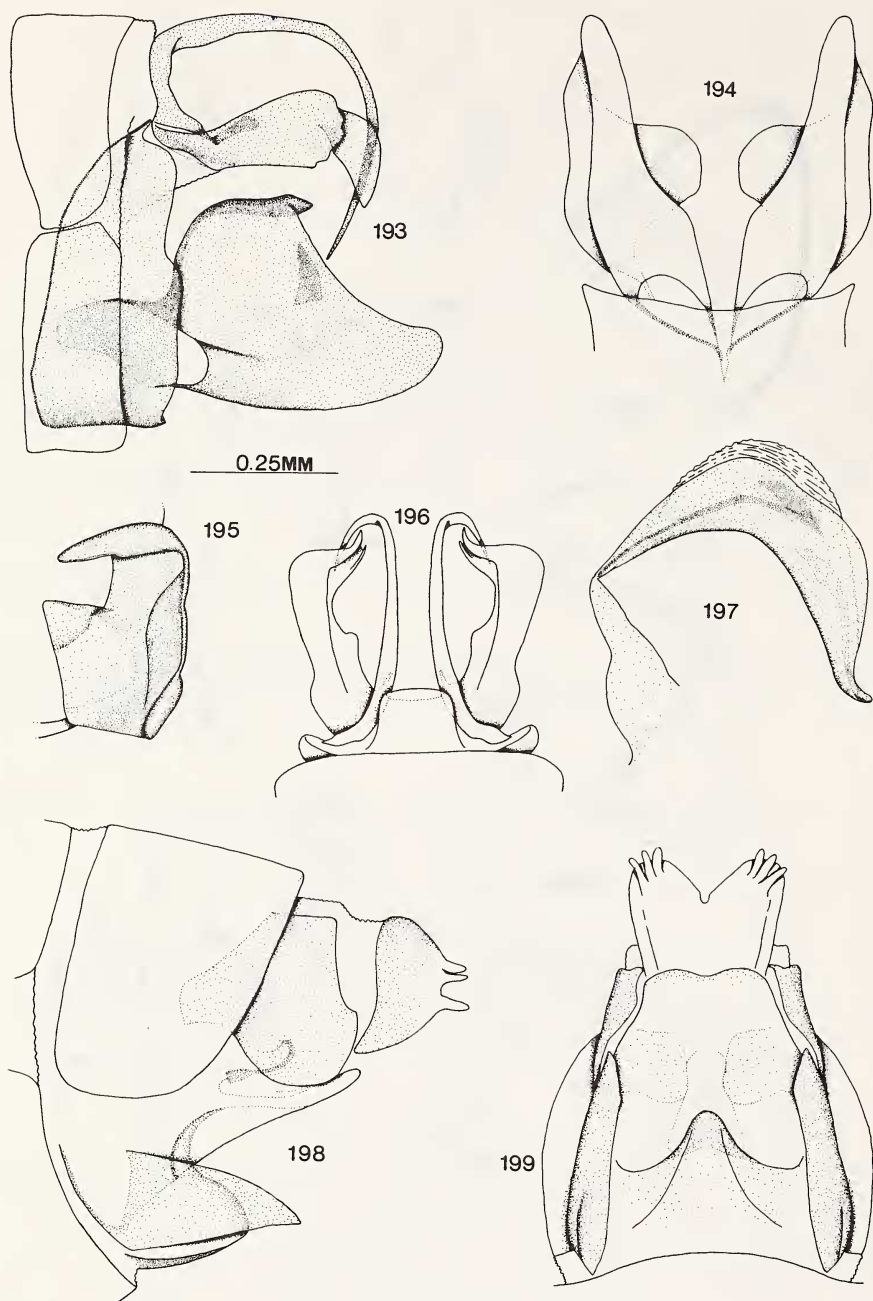


Map 39. Known distribution of *Polycentropus milaca* Etnier in North America, by state.

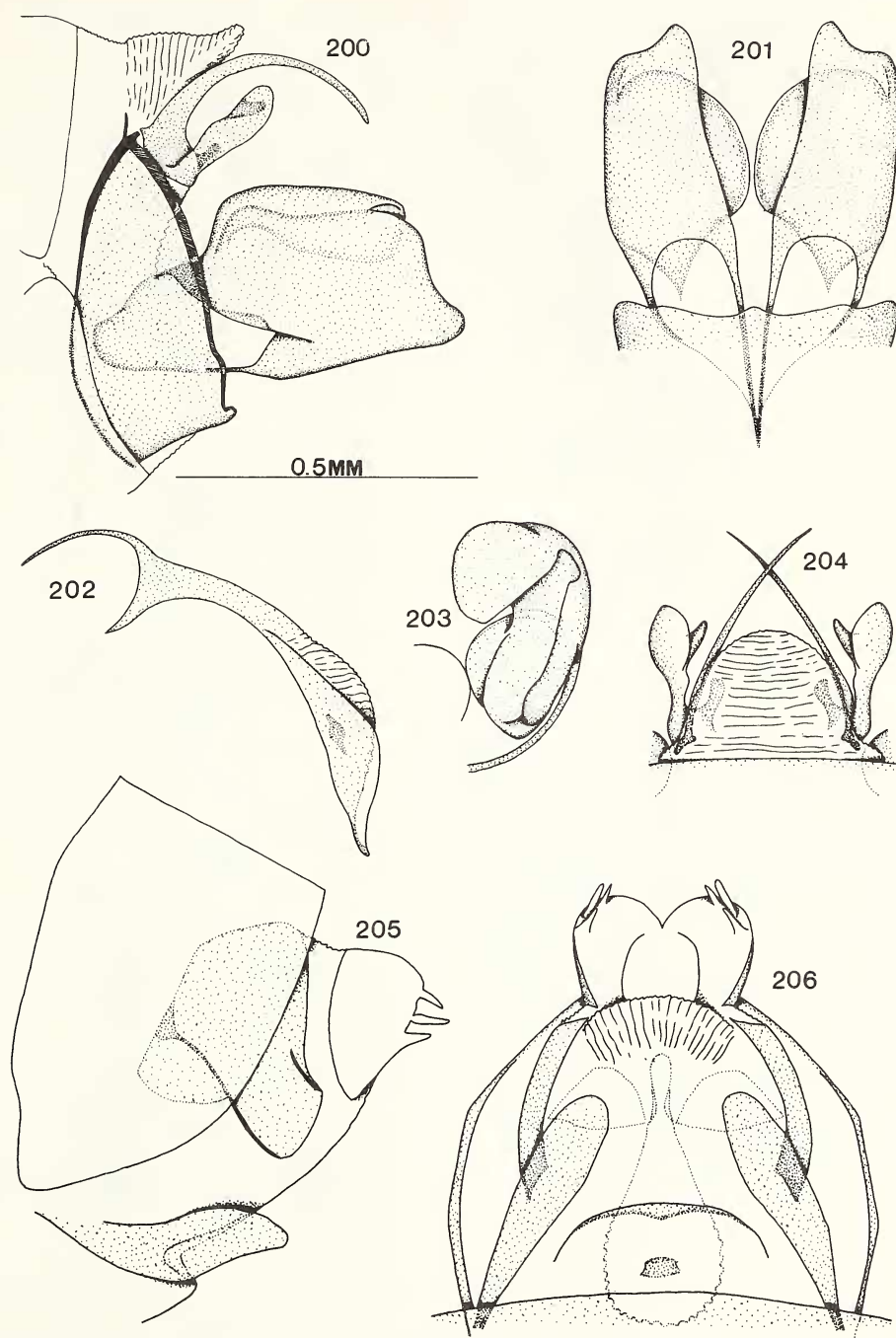


Figs. 184-192. 184-187, *Polycentropus chellus* Denning: 184, genital capsule, lateral aspect; 185, left intermediate and preanal appendages of male, dorsal aspect; 186, right intermediate and preanal appendages of male, lateral aspect; 187, genital capsule of male, ventral aspect.

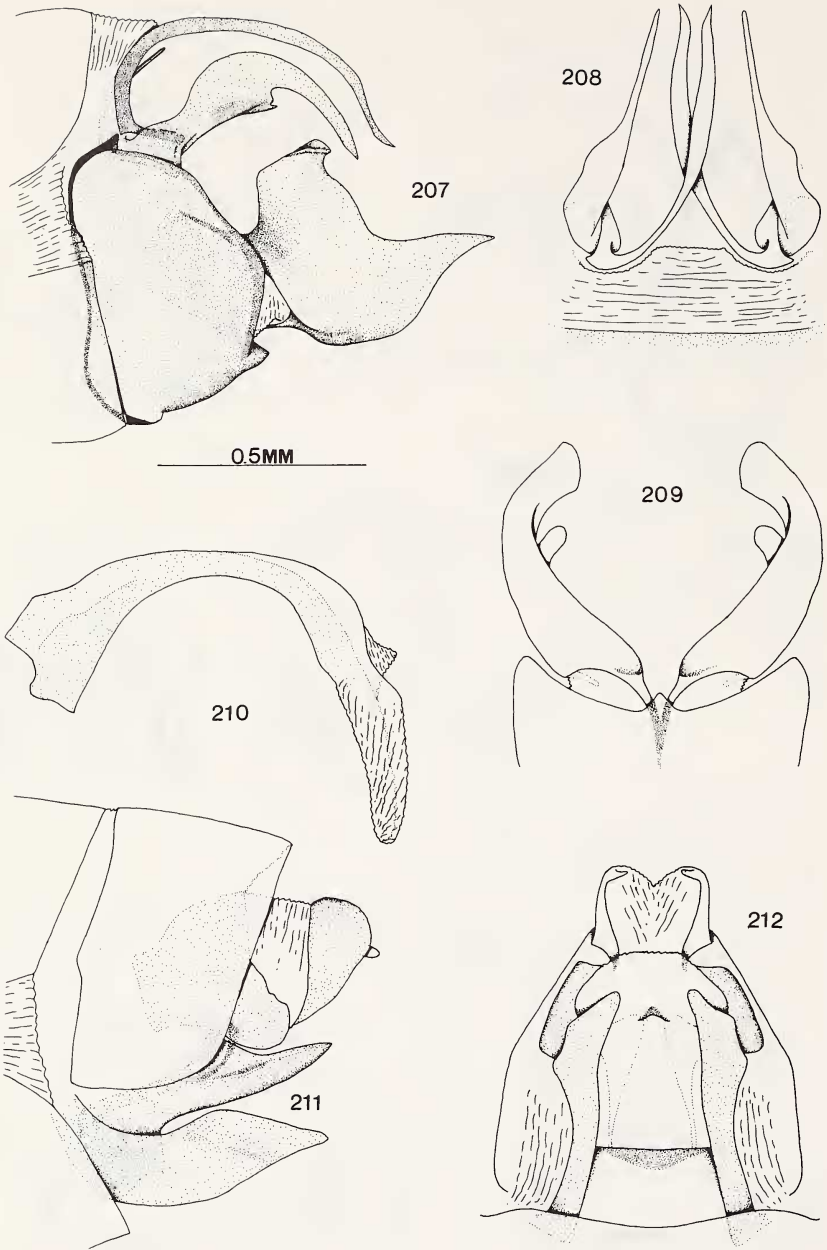
Figs. 188-191, *Polycentropus grellus* (Milne): 188, genital capsule of male, lateral aspect; 189, genital capsule of male, dorsal aspect; 190, right inferior appendage (clasper) of male, posterior aspect; 191, genital capsule of male, ventral aspect; 192, aedeagus of male, lateral aspect.



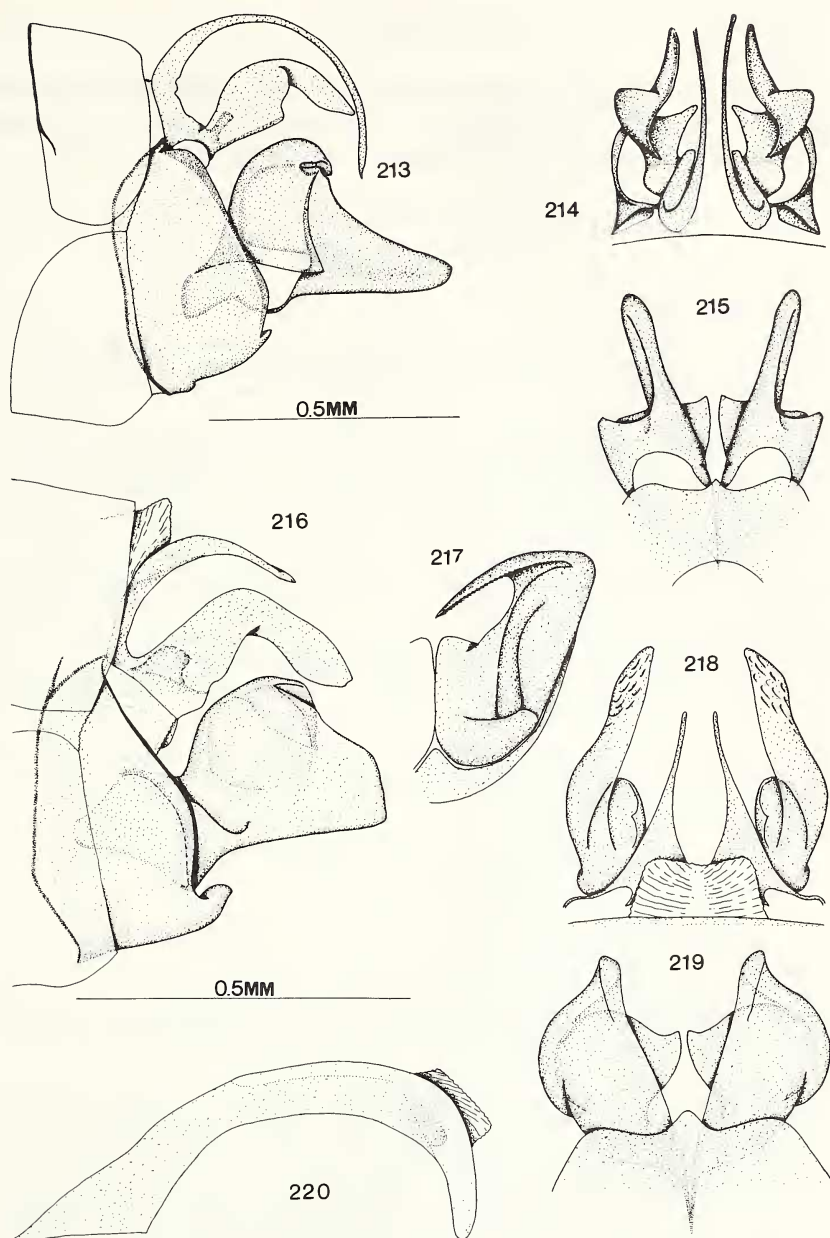
Figs. 193-199, *Polycentropus flavus* Banks: 193, genital capsule of male, lateral aspect; 194, genital capsule of male, ventral aspect; 195, right inferior appendage (clasper) of male, posterior aspect; 196, genital capsule of male, dorsal aspect; 197, aedeagus of male, lateral aspect; 198, genital segments of female, lateral aspect; 199, genital segments of female, ventral aspect.



Figs. 200-206, *Polycentropus glacialis* Ross: 200, genital capsule of male, lateral aspect; 201, genital capsule of male, ventral aspect; 202, aedeagus of male, lateral aspect; 203, right inferior appendage (clasper) of male, posterior aspect; 204, genital capsule of male, dorsal aspect; 205, genital segments of female, lateral aspect; 206, genital segments of female, ventral aspect.



Figs. 207-212, *Polycentropus interruptus* Banks: 207, genital capsule of male, lateral aspect; 208, genital capsule of male, dorsal aspect; 209, genital capsule of male, ventral aspect; 210, aedeagus of male, lateral aspect; 211, genital segments of female, lateral aspect; 212, genital segments of female, ventral aspect.



Figs. 213-220. 213-215, *Polycentropus melanae* Ross: 213, genital capsule of male, lateral aspect; 214, genital capsule of male, dorsal aspect; 215, genital capsule of male, ventral aspect. 216-220, *Polycentropus milaca* Etnier: 216, genital capsule of male, lateral aspect; 217, right inferior appendage (clasper) of male, posterior aspect; 218, genital capsule of male, dorsal aspect; 219, genital capsule of male, ventral aspect; 220, aedeagus of male, lateral aspect.

SPECIES GROUP F

Males of the two species included here have little in common so far as general appearance is concerned, but I group them together here as the aedeagus of both has, in lateral aspect, a vertical pair of strong, dark spines recessed ventrad of base of distal membranous lobe.

Polycentropus denningi Smith

Map 40; Fig. 221–226

Polycentropus denningi Smith, 1962:293.

Description.— Fore-wing length of male 8.60 mm; pale brown, costal margin darker, faintly irrorate. Hind-wing hyaline, no tint in male; female with slight reddish brown tint. Antennae pale yellow-brown. Lateral setae of vertex of head dark, mesal setae silver in broad band which extends posterad to prothorax. Spurs pale brown. Thorax red-brown, to paler red-brown or straw laterally. Legs red-brown.

Genitalia. Male. (Fig. 221–224). (Specimen from Moscow Mountain, Latah Co., Idaho, USA – holotype). Males easily recognised by preanal appendage, in lateral aspect (Fig. 221), with large, quadrate, dark plaque inserted on postero-mesal surface, this plaque with large, ventrally directed tooth at postero-ventral corner, with small, postero-dorsally directed tooth at postero-dorsal corner; and by intermediate appendage large, heavily sclerotised, well separated, with large, acuminate tooth each on disto-lateral edge, in dorsal aspect (Fig. 222).

Genitalia. Female. (Fig. 225–226). (Specimen from Moscow Mountain, Latah Co., Idaho, USA – allotype). Females distinguished by segment X sclerotised right to dorsum on a relatively broad front, in lateral aspect (Fig. 225), and with ventral extremity concealed by lateral lobe of sternum VIII; by lateral lobe of sternum VIII very much longer than greatest width, with narrow base, tapered tip, widest at mid-point by ventrally bowed ventral edge; and by internal sclerites, in ventral aspect (Fig. 226), bipartite, large, each half with anterior end bent sharply laterad.

Biology.— Nothing known other than that adult collection dates range from June 12 to September 29.

Distribution.— A strictly western species, there are records from Oregon, Idaho, western Montana, and southwestern British Columbia (map 40).

Polycentropus halidus Milne

Map 41; Fig. 227–233

Polycentropus halidus Milne, 1936:86, 88; Ross, 1944:293; Denning, 1948:23; Denning, 1956:249 (& Fig. b, not a, as stated in key – the drawings were transposed).

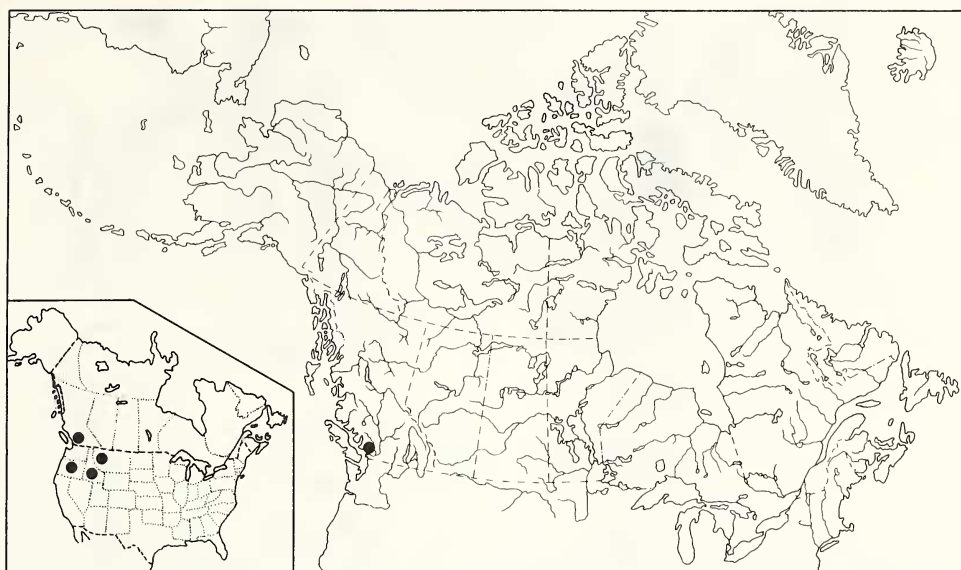
Description.— Fore-wing length of male 6.36 mm; brown, irrorate except weak to absent posterad of M. Antennae red-brown. Vertex of head deep brown. Spurs red-brown; at least some of lateral spurs notably shorter than mesal companions [impossible to see clearly on pinned type]. Thorax dark red-brown, to yellow-brown laterally. Legs brownish yellow.

Genitalia. Male. (Fig. 227–231). (Specimen from Hot Springs, New Mexico, USA – holotype). Males recognised by preanal appendage, in lateral aspect (Fig. 227), with ventral edge produced ventro-posterad as quadrate lobe, the postero-dorsal corner of which bears a stout, strongly sclerotised hook; and by intermediate appendage arched dorsad, tapered evenly and gradually distad to spinate tip, and with small seta inserted just basad of spinate tip.

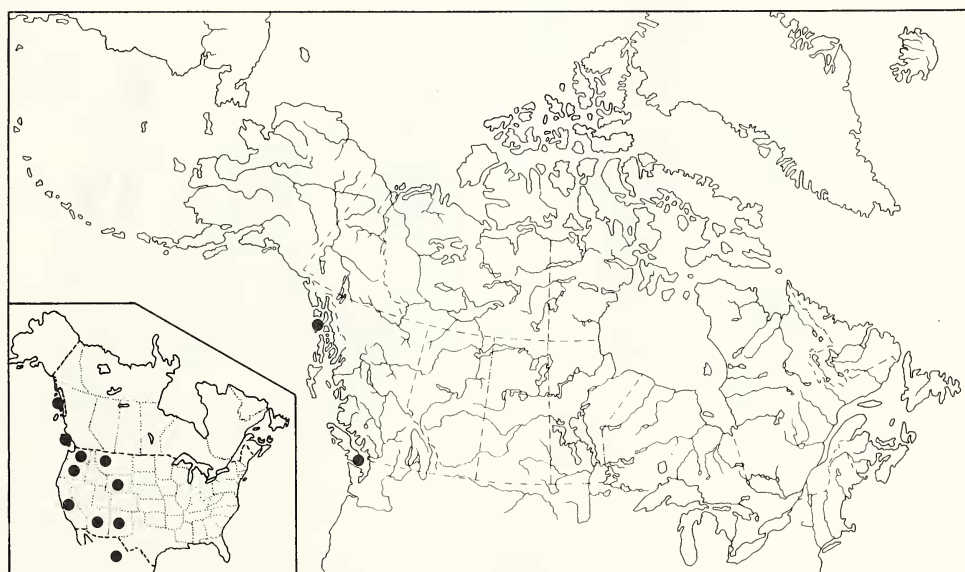
Genitalia. Female. (Fig. 232–233). (Specimen from Sacramento R., Hwy 32, California, USA). Females recognised by lateral lobe of sternum VIII, in lateral aspect (Fig. 232), longer than wide, nowhere angular, with disto-dorsal edge indented; by segment X not sclerotised to dorsum, with ventral extremities partly concealed by lateral lobes of sternum VIII; and by very large, membranous internal structure visible in ventral aspect (Fig. 233).

Biology.— Little known. Flight season dates range from July 13 to September 18.

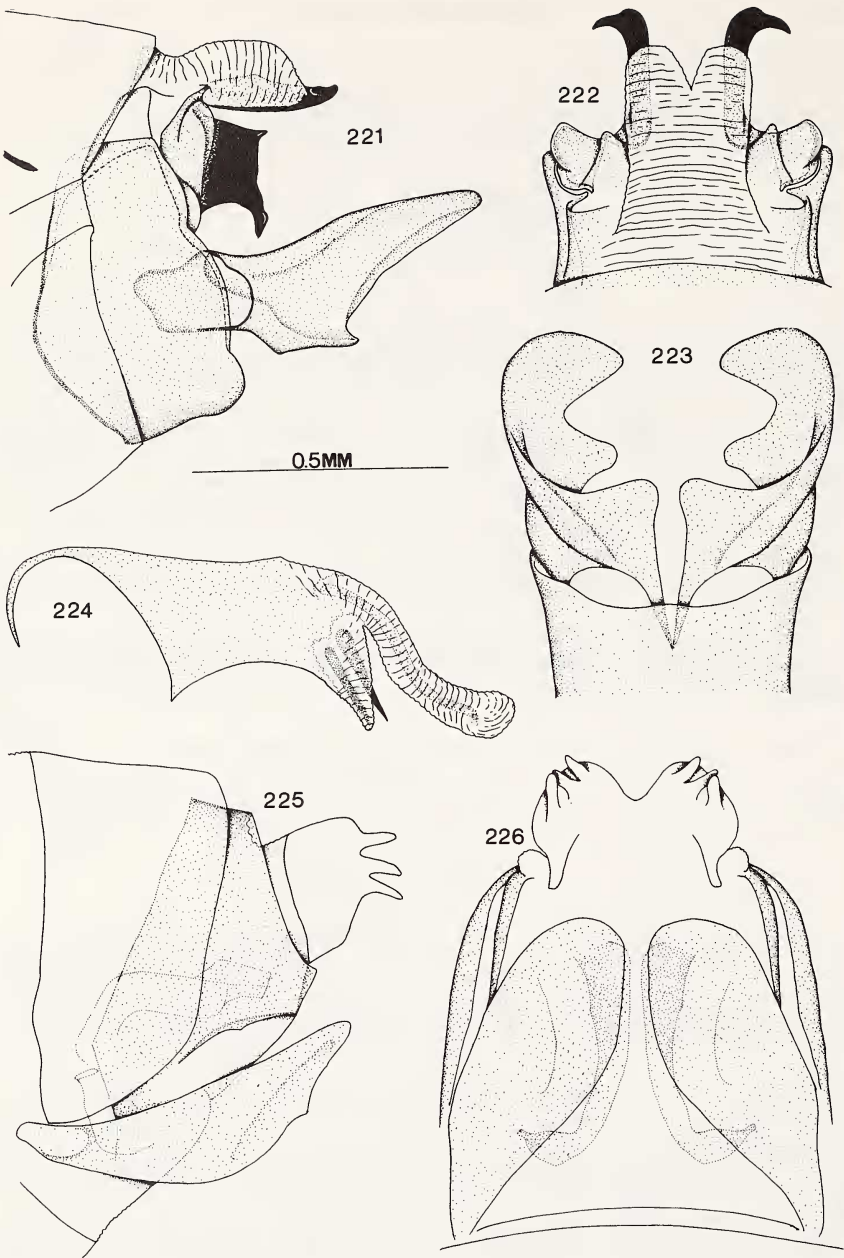
Distribution.— Western cordilleran, from Mexico to the Alaska Panhandle (map 41). Curiously, north of the United States border, the only available records are from the coastal islands.



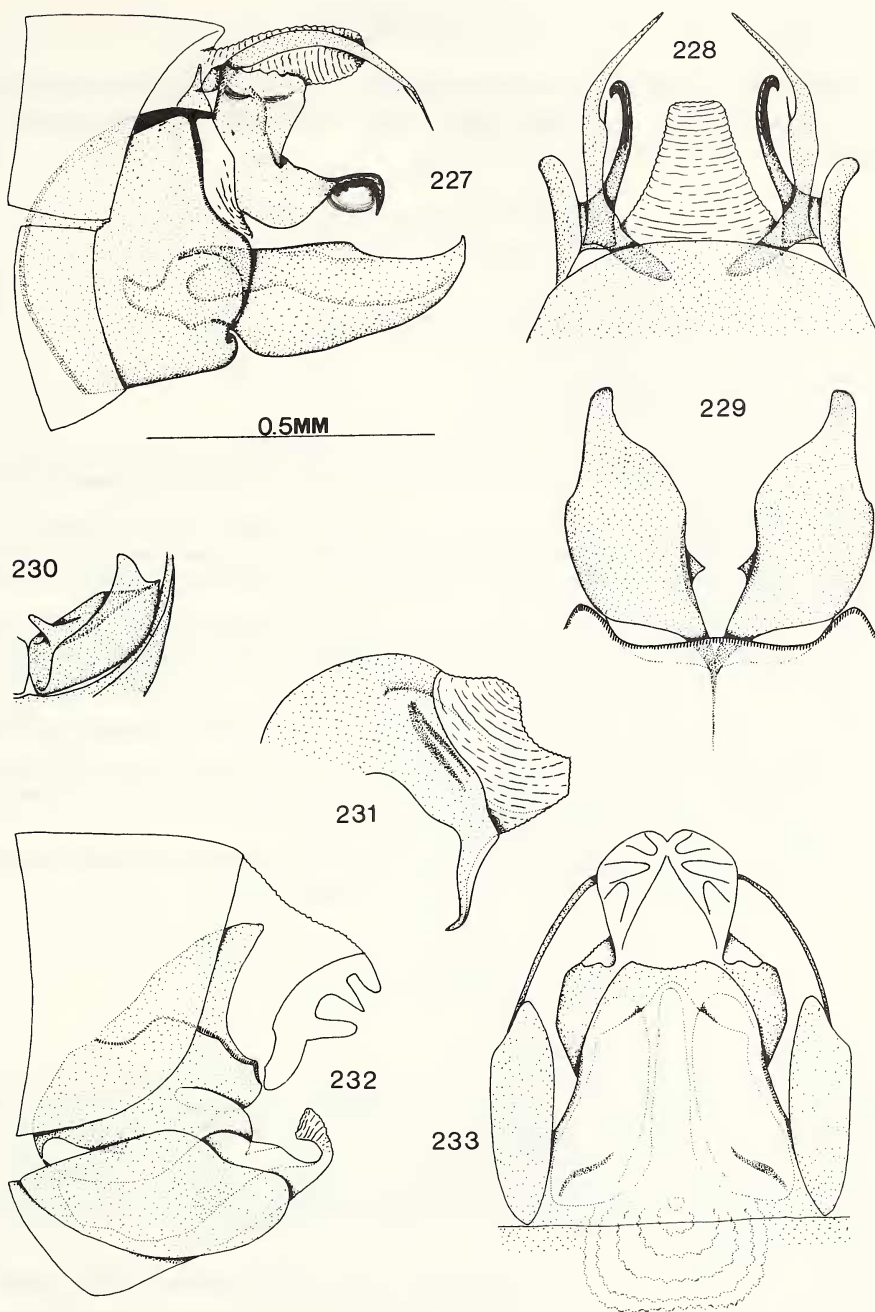
Map 40. Collection localities for *Polycentropus denningi* Smith in Canada, with known distribution in North America by state or province.



Map 41. Collection localities for *Polycentropus halidus* Milne in Canada and Alaska, with known distribution in North America by state or province.



Figs. 221-226, *Polycentropus denningi* Smith: 221, genital capsule of male, lateral aspect; 222, genital capsule of male, dorsal aspect; 223, genital capsule of male, ventral aspect; 224, aedeagus of male, lateral aspect; 225, genital segments of female, lateral aspect; 226, genital segments of female, ventral aspect.



Figs. 227-233, *Polycentropus halidus* Milne: 227, genital capsule of male, lateral aspect; 228, genital capsule of male, dorsal aspect; 229, genital capsule of male, ventral aspect; 230, right inferior appendage (clasper) of male, posterior aspect; 231, aedeagus of male, lateral aspect; 232, genital segments of female, lateral aspect; 233, genital segments of female, ventral aspect.

SPECIES GROUP G

Males of this group are characterised by relatively short, dumpy claspers, with paired lobes on mesal face; by preanal appendages simple, stout; and by intermediate appendages small, virtually concealed by preanals in lateral aspect.

Polycentropus cinereus Hagen

Map 42; Fig. 234–239

Polycentropus cinereus Hagen, 1861:293; Ross, 1944:67.

Plectrocnemia cinerea; Betten, 1934:217; Milne, 1936:86, 88; Ross, 1938a:11.

Phryganea alternicornis Harris; Hagen, 1873:297.

Holocentropus flavicornis Banks, 1907c:162; Ross, 1938a:11.

Plectrocnemia lutea Betten, 1934:219; Milne, 1936:88.

Plectrocnemia pallescens Banks, 1930b:231; Ross, 1938a:11.

Description.— Fore-wing length of male 8.11 mm; pale brownish gold. Antennae dull yellow. Spurs yellow; lateral spur of mid-leg pairs, and of hind-leg apical pair, notably shorter than mesal companion. Thorax brown to red-brown, to dull yellow laterally. Legs straw.

Genitalia. Male. (Fig. 234–237). (Specimen from Lac La Biche, Alberta). Males distinguished by clasper, in lateral aspect (Fig. 234), quadrate, with mesal lobes visible posterad of distal edge; by intermediate appendage, visible through cleared preanal appendage, short, acute-triangular; and by dorso-mesal lobe of clasper, in ventral aspect (Fig. 235), with stout seta inserted just basad of tip of lobe.

Genitalia. Female. (Fig. 238–239). (Specimen from Blindman R., Hwy 2, Red Deer, Alberta). Females recognised by lateral lobe of sternum VIII, in lateral aspect (Fig. 238), little longer than wide, with ventral edge evenly curved, not sclerotised to dorsum, with ventral extremity concealed by lateral lobe of sternum VIII; and by internal sclerite, in ventral aspect (Fig. 239), a simple, wide-apertured ring.

Biology.— Adults of this species seem to emerge from all types of flowing and standing waters; from large or small rivers and streams, from torrential waters or meandering creeks, with silt or boulder bottoms. Flight season dates for Canada range from May 26 to September 18, with predominance in July and perhaps late June.

Distribution.— South of tree-line, from Alaska to Newfoundland, and south to Texas (map 42). Not yet recorded from the Gulf Coast or the American southwest.

Polycentropus sabulosus Leonard & Leonard

Map 43; Fig. 240–244

Polycentropus sabulosus Leonard & Leonard, 1949a:3.

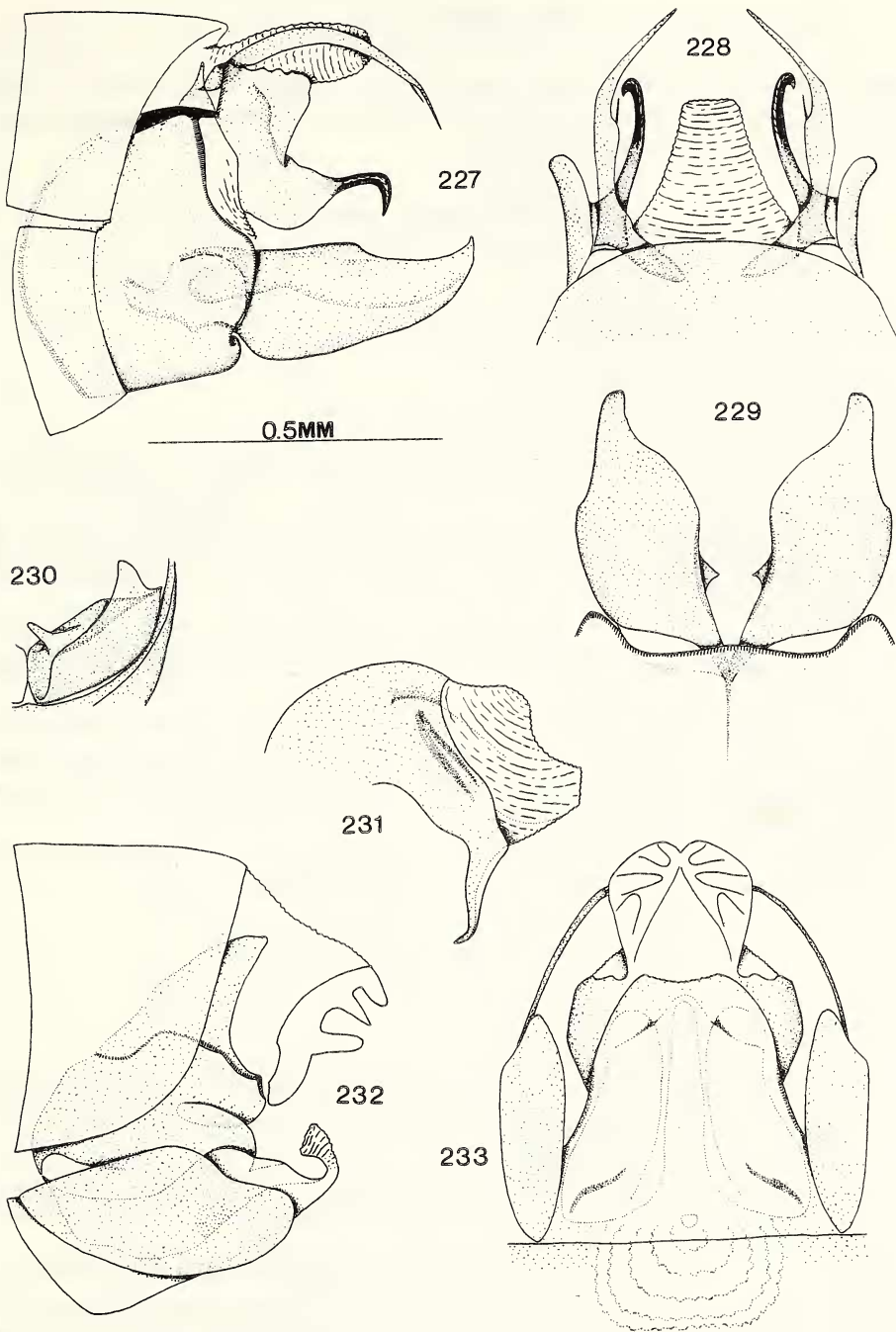
Description.— Fore-wing length of male 5.80 mm; dark red-brown, irrorate along costal and apical margins. Hind-wing palely tinted grey-brown. Antennae yellow-brown; annuli with distal third paler. Vertex of head red-brown, warts paler; median setae almost black along posterior two-thirds of vertex. Spurs yellow-brown. Thorax generally warm red-brown; a deeper shade on dorsum. Legs deep straw.

Genitalia. Male. (Fig. 240–244). (Specimen from Au Sable R., Crawford Co., Michigan, USA – paratype). Males distinguished by clasper, in lateral aspect (Fig. 240), with lobes of mesal face not directly visible; by clasper polygonal, the edges more or less straight; and by intermediate appendage a very slender process curved latero-anterad (Fig. 240, 242).

Genitalia. Female. Unknown.

Biology.— At least a species of flowing water. Ellis (1962) reported further collections of the species, in which he took possible females. Nothing more has been heard of this and, as he failed to differentiate the dates on which males were taken from those on which females alone were taken, his seasonal flight data for this species is somewhat open to question. The type material was taken on June 1–3.

Distribution.— Presently known only from Michigan. It is possible, of course, that males of this species have been mistaken for males of *P. cinereus* previous to, and possibly after



Figs. 227-233, *Polycentropus halidus* Milne: 227, genital capsule of male, lateral aspect; 228, genital capsule of male, dorsal aspect; 229, genital capsule of male, ventral aspect; 230, right inferior appendage (clasper) of male, posterior aspect; 231, aedeagus of male, lateral aspect; 232, genital segments of female, lateral aspect; 233, genital segments of female, ventral aspect.

SPECIES GROUP G

Males of this group are characterised by relatively short, dumpy claspers, with paired lobes on mesal face; by preanal appendages simple, stout; and by intermediate appendages small, virtually concealed by preanals in lateral aspect.

Polycentropus cinereus Hagen

Map 42; Fig. 234–239

Polycentropus cinereus Hagen, 1861:293; Ross, 1944:67.

Plectrocnemia cinerea; Betten, 1934:217; Milne, 1936:86, 88; Ross, 1938a:11.

Phryganea alternicornis Harris; Hagen, 1873:297.

Holocentropus flavicornis Banks, 1907c:162; Ross, 1938a:11.

Plectrocnemia lutea Betten, 1934:219; Milne, 1936:88.

Plectrocnemia pallescens Banks, 1930b:231; Ross, 1938a:11.

Description.— Fore-wing length of male 8.11 mm; pale brownish gold. Antennae dull yellow. Spurs yellow; lateral spur of mid-leg pairs, and of hind-leg apical pair, notably shorter than mesal companion. Thorax brown to red-brown, to dull yellow laterally. Legs straw.

Genitalia. Male. (Fig. 234–237). (Specimen from Lac La Biche, Alberta). Males distinguished by clasper, in lateral aspect (Fig. 234), quadrate, with mesal lobes visible posterad of distal edge; by intermediate appendage, visible through cleared preanal appendage, short, acute-triangular; and by dorso-mesal lobe of clasper, in ventral aspect (Fig. 235), with stout seta inserted just basad of tip of lobe.

Genitalia. Female. (Fig. 238–239). (Specimen from Blindman R., Hwy 2, Red Deer, Alberta). Females recognised by lateral lobe of sternum VIII, in lateral aspect (Fig. 238), little longer than wide, with ventral edge evenly curved, not sclerotised to dorsum, with ventral extremity concealed by lateral lobe of sternum VIII; and by internal sclerite, in ventral aspect (Fig. 239), a simple, wide-apertured ring.

Biology.— Adults of this species seem to emerge from all types of flowing and standing waters; from large or small rivers and streams, from torrential waters or meandering creeks, with silt or boulder bottoms. Flight season dates for Canada range from May 26 to September 18, with predominance in July and perhaps late June.

Distribution.— South of tree-line, from Alaska to Newfoundland, and south to Texas (map 42). Not yet recorded from the Gulf Coast or the American southwest.

Polycentropus sabulosus Leonard & Leonard

Map 43; Fig. 240–244

Polycentropus sabulosus Leonard & Leonard, 1949a:3.

Description.— Fore-wing length of male 5.80 mm; dark red-brown, irrorate along costal and apical margins. Hind-wing palely tinted grey-brown. Antennae yellow-brown; annuli with distal third paler. Vertex of head red-brown, warts paler; median setae almost black along posterior two-thirds of vertex. Spurs yellow-brown. Thorax generally warm red-brown; a deeper shade on dorsum. Legs deep straw.

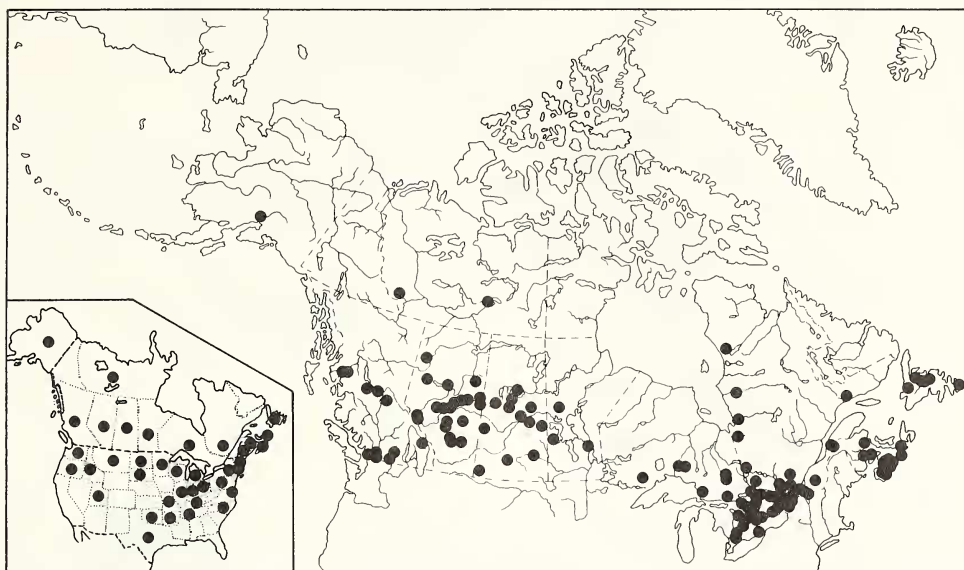
Genitalia. Male. (Fig. 240–244). (Specimen from Au Sable R., Crawford Co., Michigan, USA – paratype). Males distinguished by clasper, in lateral aspect (Fig. 240), with lobes of mesal face not directly visible; by clasper polygonal, the edges more or less straight; and by intermediate appendage a very slender process curved latero-anterad (Fig. 240, 242).

Genitalia. Female. Unknown.

Biology.— At least a species of flowing water. Ellis (1962) reported further collections of the species, in which he took possible females. Nothing more has been heard of this and, as he failed to differentiate the dates on which males were taken from those on which females alone were taken, his seasonal flight data for this species is somewhat open to question. The type material was taken on June 1–3.

Distribution.— Presently known only from Michigan. It is possible, of course, that males of this species have been mistaken for males of *P. cinereus* previous to, and possibly after

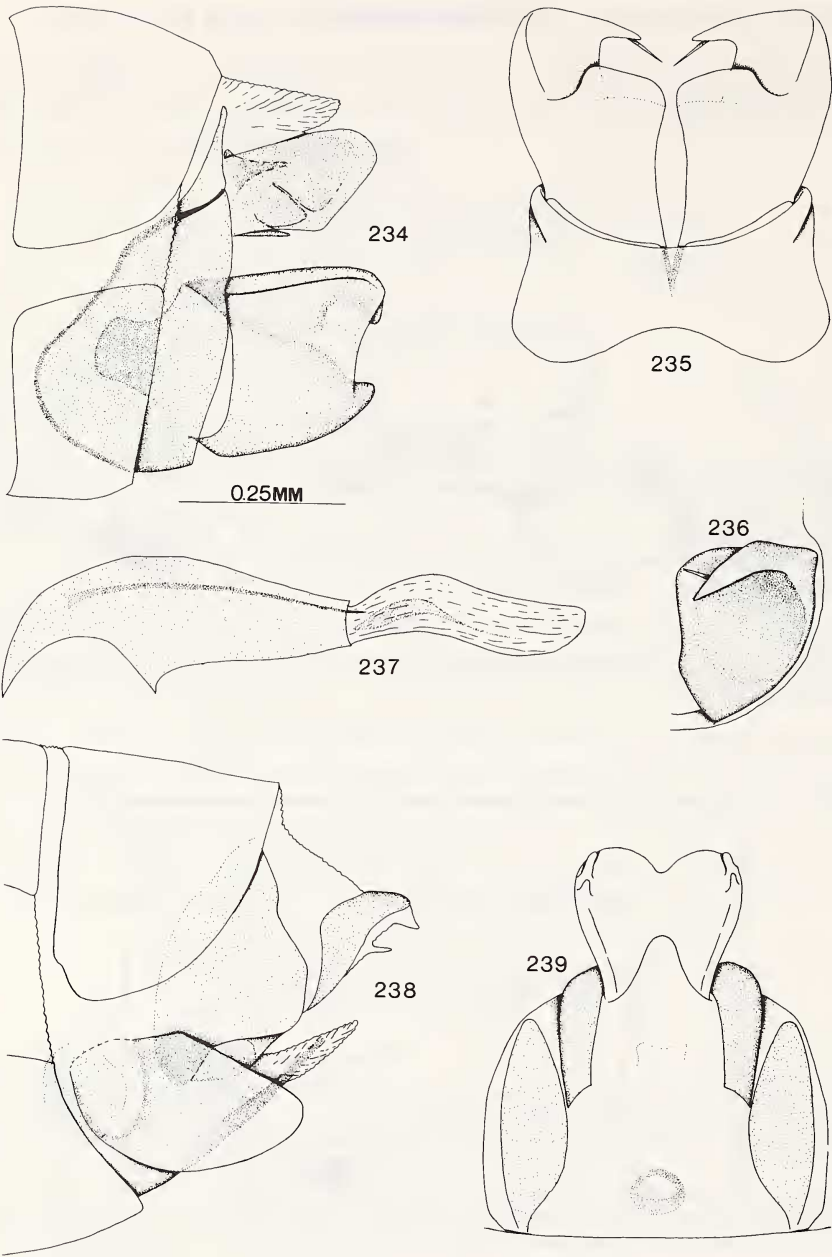
description of *P. sabulosus*, if so, a wider distribution may be masked by *P. cinereus*.



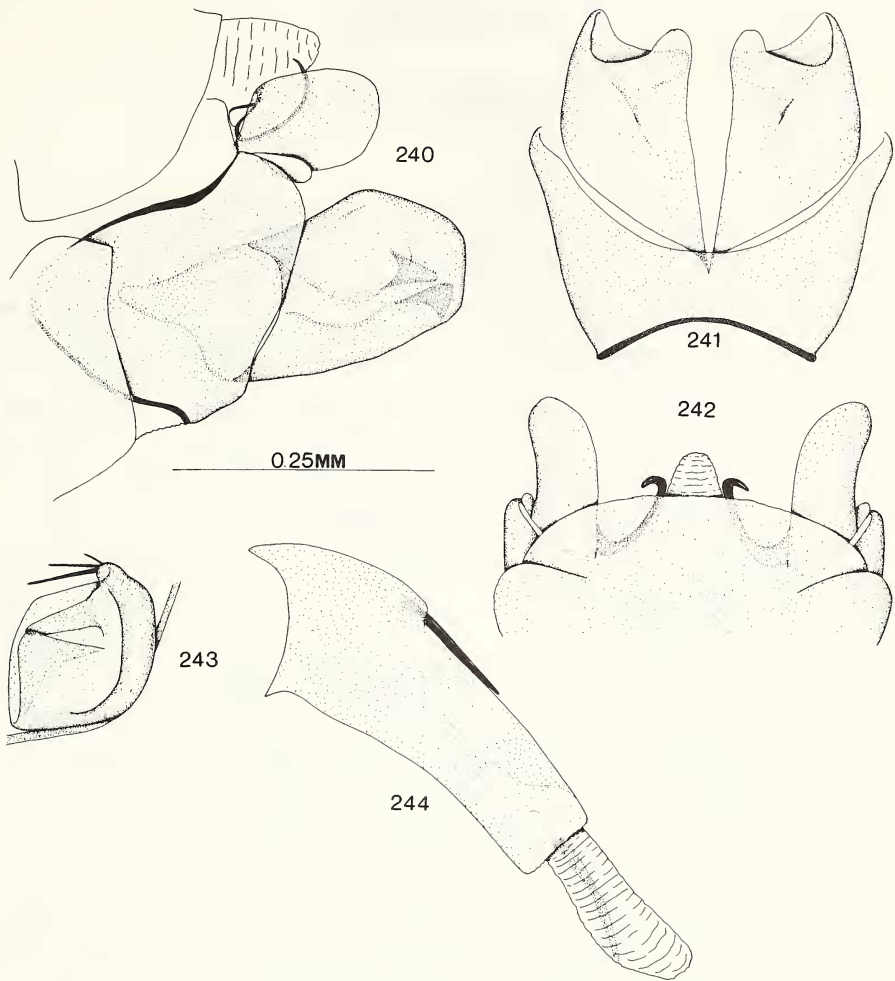
Map 42. Collection localities for *Polycentropus cinereus* Hagen in Canada and Alaska, with known distribution in North America by state or province.



Map 43. Known distribution of *Polycentropus sabulosus* Leonard and Leonard in North America, by state.



Figs. 234-239, *Polycentropus cinereus* Hagen: 234, genital capsule of male, lateral aspect; 235, genital capsule of male, ventral aspect; 236, right inferior appendage (clasper) of male, posterior aspect; 237, aedeagus of male, lateral aspect 238, genital segments of female, lateral aspect; 239, genital segments of female, ventral aspect.



Figs. 240-244, *Polycentropus sabulosus* Leonard & Leonard: 240, genital capsule of male, lateral aspect; 241, genital capsule of male, ventral aspect; 242, genital capsule of male, dorsal aspect; 243, right inferior appendage (clasper) of male, posterior aspect; 244, aedeagus of male, lateral aspect.

SPECIES GROUP H

Polycentropus colei Ross

Map 44; Fig. 5, 245–249

Polycentropus colei Ross, 1941:76; Ross, 1944:293.

Description.— Fore-wing length of male 6.55 mm; pale grey-brown. Hind-wing palely tinted grey. Antennae yellow. Vertex of head dullbrown. Spurs dull brown; lateral spur of each mid- and hind-leg pair shorter than mesal companion. Thorax red- to yellow-brown, to yellow-brown to straw laterally. Legs light yellow-brown.

Genitalia. Male. (Fig. 245–249). (Specimen from St Hippolyte, Québec). Males recognised by clasper, in lateral aspect (Fig. 245), short, almost quadrate, with lobe of dorso-mesal face visible; by preanal appendage with process of posterior edge set off from the main body of the appendage by sharp declivity, this process with rounded, large dorsal portion and small, acuminate ventral hook; and by intermediate appendage short, stout, curved dorso-laterad.

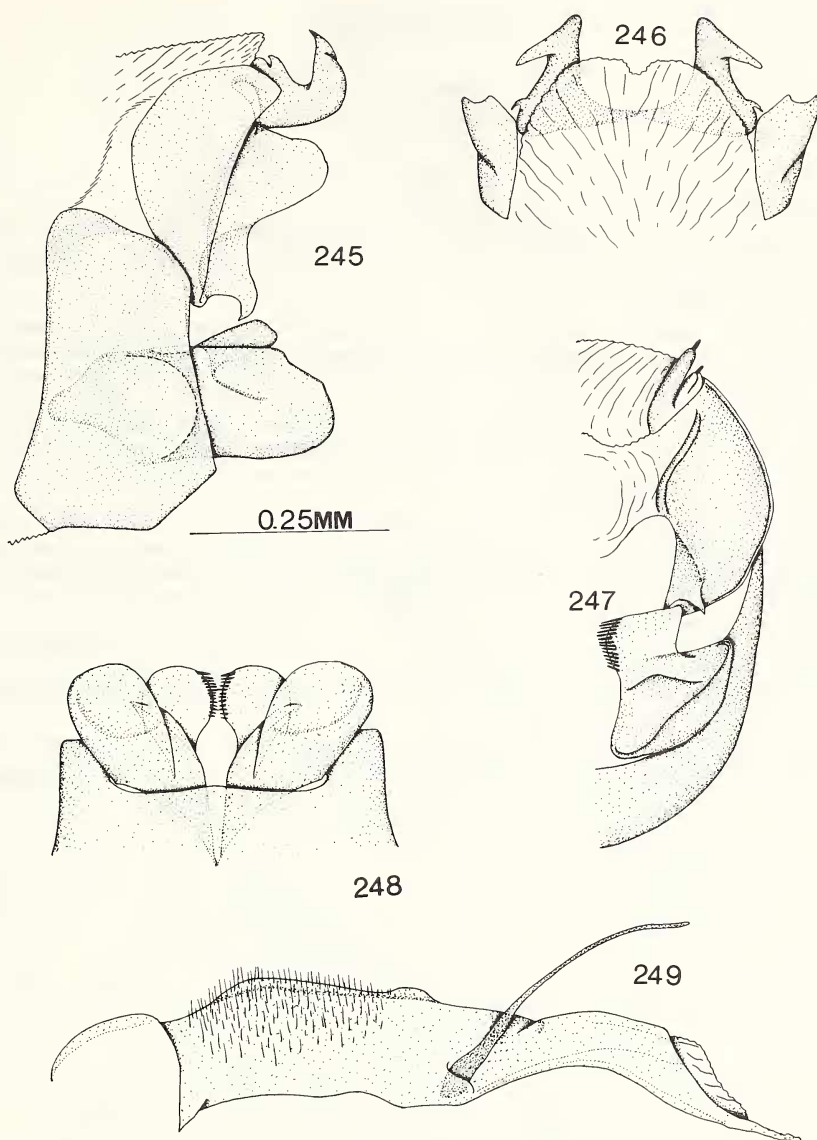
Genitalia. Female. Unknown.

Biology.— Nothing known except flight season dates from Canada range from July 9 to August 5.

Distribution.— Presently known only from Tennessee and southern Québec.



Map 44. Collection localities for *Polycentropus colei* Ross in Canada, with known distribution in North America by state or province.



Figs. 245-249, *Polycentropus colei* Ross: 245, genital capsule of male, lateral aspect; 246, genital capsule of male, dorsal aspect; 247, genital capsule of male, right side, posterior aspect; 248, genital capsule of male, ventral aspect; 249, aedeagus of male, lateral aspect.

SPECIES GROUP I

Polycentropus picicornis Stephens

Map 45; Fig. 250–255

Polycentropus picicornis Stephens, 1836:177; Blickle & Morse, 1955:96.

Holocentropus picicornis; This is the name now used in Europe.

In Europe there are four other specific epithets as synonyms, all with short currency in the 1800s. There are also three varietal names in use in Europe. See Fischer (1962:107) and (1972:42) for details.

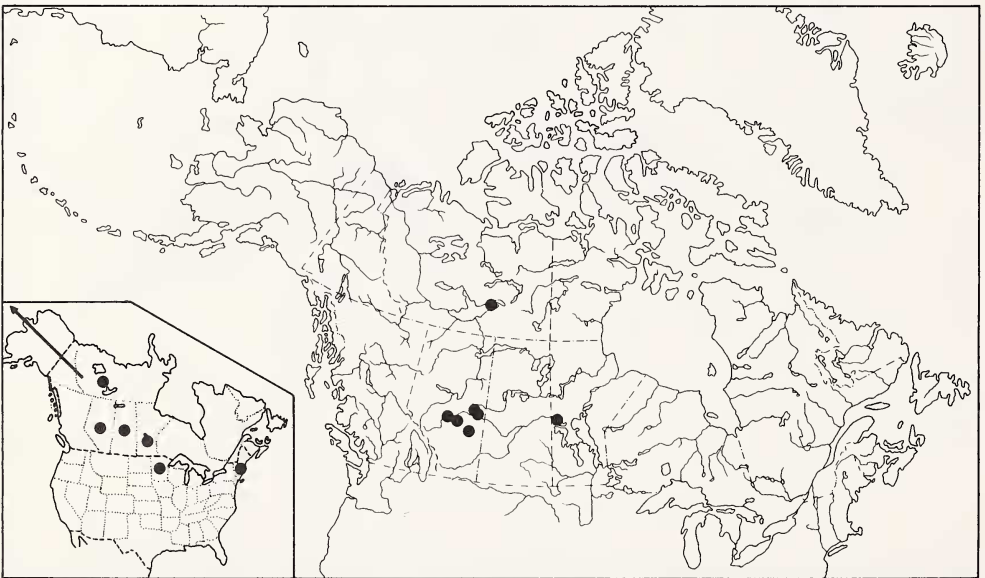
Description.— Fore-wing length of male 6.16 mm; brown, golden brown in female. Hind-wing tinted pale brown, red-brown in female. Antennae pale grey-brown. Vertex of head red-brown; anterior, triangular portion darker brown in female. Spurs brownish yellow; lateral spur of each mid-leg pair, and of hind-leg apical pair much shorter than mesal companion. Thorax deep red-brown, to dark brown laterally. Legs brownish yellow.

Genitalia. Male. (Fig. 250–253). (Specimen from Mann Lk., Ashmont, Alberta). Males recognised by clasper, in lateral aspect (Fig. 250), large, roughly triangular, directed postero-dorsad, with small process on mesal face just basad of tip; and by preanal appendage large, with basal stem and dorsal and ventral lobes, paired preanal appendages connected by intermediate strap dorsad of aedeagus (fig. 251).

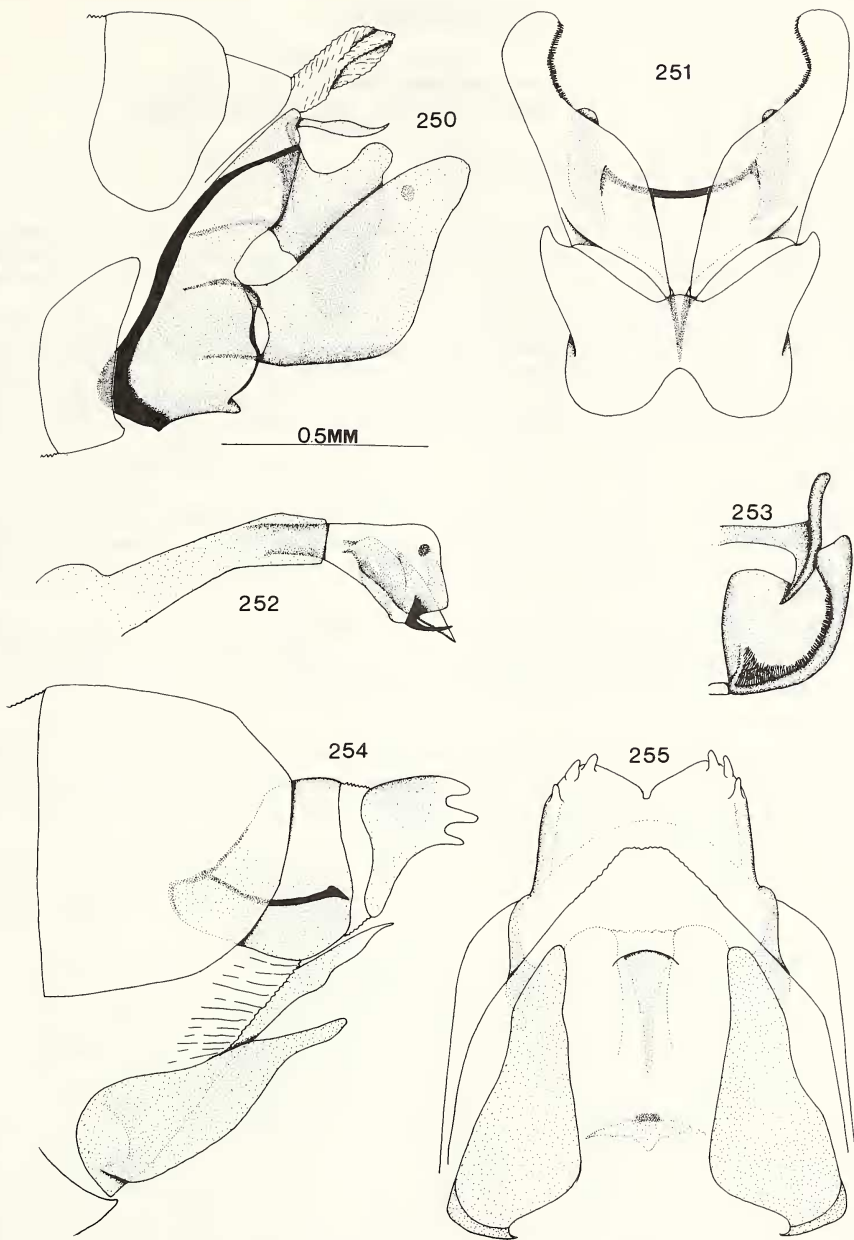
Genitalia. Female. (Fig. 254–255). (Specimen from Simpson Island, E end Great Slave Lk, Northwest Territories). Females distinguished by lateral lobe of sternum VIII, in lateral aspect (Fig. 254), much longer than wide, tapered throughout, dorsal and ventral edges sinuate, tip not quite acuminate; by segment X sclerotised to dorsum on wide front, ventral extremity far removed from lateral lobe of sternum VIII; and by segment X lateral wall with ventrally bowed dark band which does not quite reach posterior edge.

Biology.— Certainly a species of standing waters (large lakes to small sedge or *Typha* sloughs, but available records make no mention of running waters. Flight season dates for Canada range from June 21 to July 26.

Distribution.— In North America this holarctic species has been recorded erratically from, Great Slave Lk to central Alberta, and Minnesota, with a record from New Hampshire (map 45).



Map 45. Collection localities for *Polycentropus picicornis* Stephens in Canada and Alaska, with known distribution in North America by state or province.



Figs. 250-255, *Polycentropus picicornis* Stephens: 250, genital capsule of male, lateral aspect; 251, genital capsule of male, ventral aspect; 252, aedeagus of male, lateral aspect; 253, right inferior appendage (clasper) of male, posterior aspect; 254, genital segments of female, lateral aspect; 255, genital segments of female, ventral aspect.

SPECIES GROUP J

Polycentropus variegatus Banks

Map 46; Fig. 256–261

Polycentropus variegatus Banks, 1900:259; Ross, 1944:293.*Holocentropus variegatus*; Betten, 1934:220.

Description.— Fore-wing length of male 7.72 mm; translucent grey-brown, with hint of irroration peripherally. Antennae very pale brownish yellow. Vertex of head dull reddish brown. Spurs yellow-brown; lateral spur of each mid-leg pair notably shorter than mesal companion. Thorax red-brown to brown, to brownish yellow laterally. Legs brownish yellow. In the female colours are darker, with yellows replaced by browns.

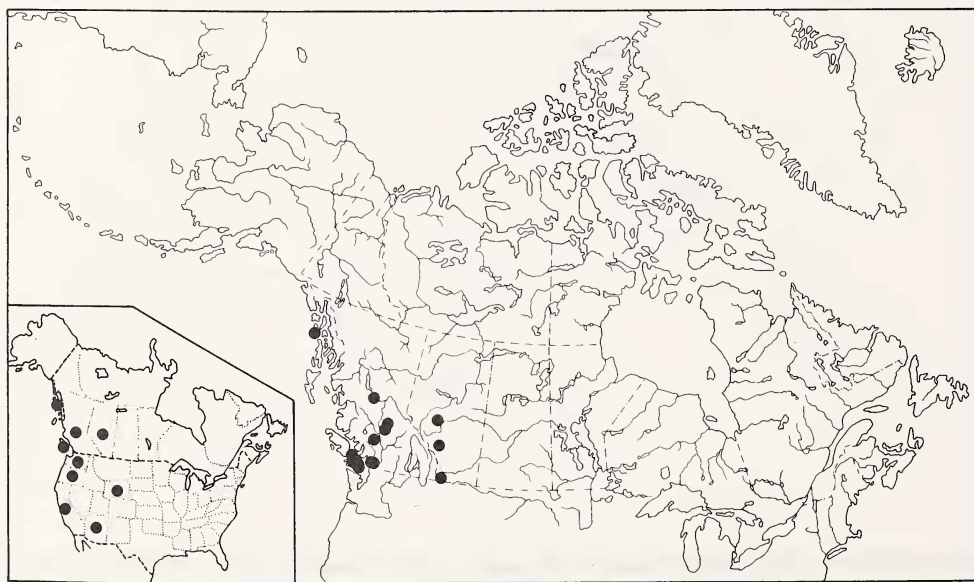
Genitalia. Male. (Fig. 256–259). (Specimen from Cold Ck, Hwy 16, Nojack, Alberta). Males recognised by clasper, in lateral aspect (Fig. 256), stout basally, with slender tip curved dorsad; by preanal appendage high, narrow, with massive distal lobe delimited by distinct declivity, the lobe with narrow stem then greatly widened about mid-point, tapered to broadly rounded tip; by preanal appendage also with long, slender, complexly curved process from dorsal extremity, this process ultimately directed posterad; and by intermediate appendage long, slender, sinuate distally acuminate, heavily sclerotised.

The male holotype was examined during preparation of this paper and was found to differ in no essential feature from the specimen illustrated here.

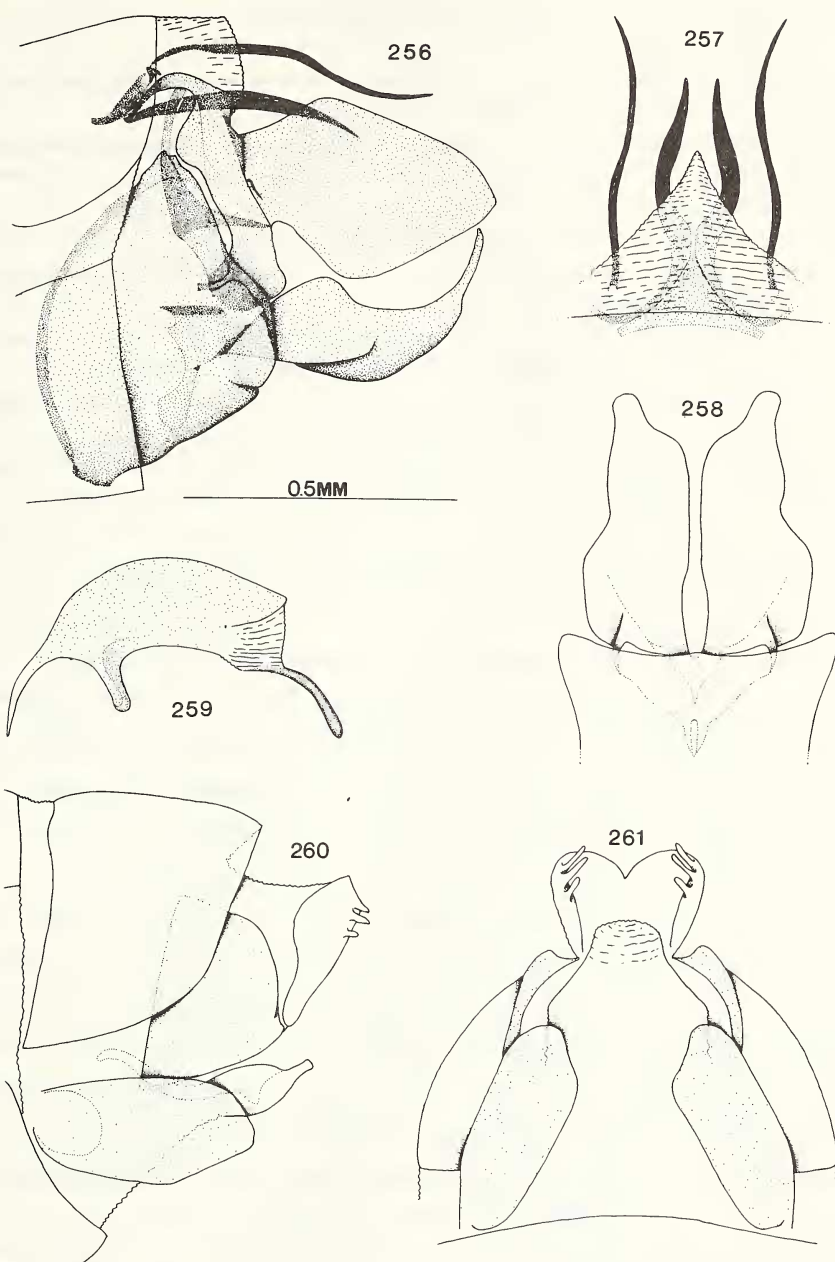
Genitalia. Female. (Fig. 260–261). (Specimen from Cold Ck, Hwy 16, Nojack, Alberta). Females distinguished by lateral lobe of sternum VIII, in lateral aspect (Fig. 260), longer than wide, roughly ovate; by segment X not sclerotised to dorsum, with ventral extremity concealed by lateral lobe of sternum VIII; and by vulval scale base swollen, and distal quarter rectangular.

Biology.— Adults have been taken adjacent to medium-sized, barely moving rivers and creeks, and from small creeks over gravel beds and with alternating pools and shallow riffles. It has also been recorded from lakes. Flight season dates from Canada range from June 2 to September 30.

Distribution.— From Arizona to Alberta and the Alaska Panhandle (map 46). In Canada this species has been recorded from the wooded Plains, Foothills, and subalpine areas of Alberta, west to southern British Columbia and Vancouver Island.



Map 46. Collection localities for *Polycentropus variegatus* Banks in Canada and Alaska, with known distribution in North America by state or province.



Figs. 256-261, *Polycentropus variegatus* Banks: 256, genital capsule of male, lateral aspect; 257, genital capsule of male, dorsal aspect; 258, genital capsule of male, ventral aspect; 259, aedeagus of male, lateral aspect; 260, genital segments of female, lateral aspects; 261, genital segments of female, ventral aspect.

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It is with much appreciation that I acknowledge administration of the above contract by the University of Alberta, and the provision of accomodation by the Department of Entomology. George E. Ball, then Chairman of the Department, who was technically co-ordinator of the work, left me to get on with it. His confidence is appreciated.

To my wife, Susan, and two daughters, respectively entomological widow and orphans more often than they cared for, I can only offer my heartfelt thanks for their understanding and co-operation during protracted absences in the field, or while at the microscope or typewriter.

I wish to extend my warmest thanks to the following institutions and/or individuals for their various assistances during the course of preparing the MS. Their assistance ranged from loan of requested material, through allowing personal visits to their collections, provision of comments and information, assistance in tracking down material, to discussion of problems. They are:

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For a permit to collect I thank the Government of The Yukon.

While on field work during the two summers of the project I was the grateful recipient of the hospitality of colleagues and friends scattered across Canada, and too numerous to mention individually. I thank them all. One only shall I mention individually. Horace Drury of

Fairbanks, Alaska, most kindly took a day to fly me to several points in the Brooks Range of northern Alaska. Never mind that flying is one of his many accomplishments and pastimes, it was a marvelously generous gesture on his part for which I can offer little in return except my gratitude.

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And finally, in the hope that it is unnecessary, I apologise to anyone not acknowledged here, who should have been.

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Those entries distinguished by an asterisk (*) were used only for accumulation of distributional data, and are not directly referred to in the text.

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INDEX TO NAMES OF TAXA

(Synonyms in italics)

FAMILY GROUP TAXA

Polycentropodidae, 143, 145

Psychomyiidae, 145

GENERA AND SUBGENERA

Cernotina Ross, 145–146

Cyrnellus Banks, 146, 155

Neureclipsis McLachlan, 145, 158

Nyctiophylax Brauer, 146, 165

Polycentropus Curtis, 146, 174

SPECIES AND SUBSPECIES

adironica Banks, *Plectrocnemia*, 212*affinis* (Banks), *Nyctiophylax*, 165–166*affinis* Banks, *Polycentropus*, 166*albipuncta* Banks, *Plectrocnemia*, 179*albipunctus* (Banks), *Polycentropus*, 176,
178–179*alternicornis* Harris, *Phryganea*, 234*aureola* Banks, *Plectrocnemia*, 212*aureolus* (Banks), *Polycentropus*, 176, 178,
212*banksi* Morse, *Nyctiophylax*, 165–166*bimaculata* (L.), *Neureclipsis*, 158–159*bimaculata* (L.), *Rhyncophila*, 159*bimaculata* L., *Phryganea*, 159*bimaculatus* (L.), *Cyrnus*, 159*blicklei* Ross & Yamamoto,*Polycentropus*, 175, 178, 195*calcea* Ross, *Cernotina*, 146–147*carolinensis* Banks, *Polycentropus*, 175,
195*celta* Denning, *Nyctiophylax*, 165–166*centralis* Banks, *Polycentropus*, 175, 179,
196*chellus* Denning, *Polycentropus*, 175, 218*cinerea* (Hagen), *Plectrocnemia*, 234*cinereus* Hagen, *Polycentropus*, 177–178,
234*clinei* (Milne), *Polycentropus*, 176–177,
190*clinei* Milne, *Plectrocnemia*, 190*colei* Ross, *Polycentropus*, 177, 238*confusus* (Hagen), *Plectrocnemia*, 196*confusus* Hagen, *Polycentropus*, 175, 178,
196, 212*crassicornis* Walker, *Polycentropus*, 176,
178, 212*crassicornis* (Walker), *Plectrocnemia*, 212*crepuscularis* (Walker), *Neureclipsis*, 158,
160*crepuscularis* (Walker), *Polycentropus*,
160*crepuscularis* non Walker, *Neureclipsis*,
159*crepuscularis* Walker, *Brachycentrus*, 160*denningi* Smith, *Polycentropus*, 177–178,
230*dubitans* Walker, *Hydropsyche*, 159*elarus* Ross, *Polycentropus*, 174, 178, 197*flavicornis* Banks, *Holocentropus*, 234*flavus* (Banks), *Polycentropus*, 175, 179,
218*flavus* Banks, *Holocentropus*, 218*fraternus* (Banks), *Cyrnellus*, 155*fraternus* (Banks), *Nyctiophylax*, 155*glacialis* Ross, *Holocentropus*, 219*glacialis* Ross, *Polycentropus*, 175, 179,
219*grellus* (Milne), *Polycentropus*, 176, 219*grellus* Milne, *Holocentropus*, 219*halidus* Milne, *Polycentropus*, 177, 179,
230*iculus* Ross, *Polycentropus*, 177–178, 180*interruptus* (Banks), *Polycentropus*, 176,
179, 219*interruptus* Banks, *Holocentropus*, 219*jenula* Denning, *Polycentropus*, 176, 213*longus* Banks, *Holocentropus*, 220*lutea* Betten, *Plectrocnemia*, 234*maculatus* Banks, *Polycentropus*, 175, 179,
197*marginalis* (Banks), *Cyrnellus*, 155*marginalis* Banks, *Nyctiophylax*, 155*melanae* (Ross), *Polycentropus*, 175, 220*melanae* Ross, *Holocentropus*, 220